THE GEOGRAPHICAL JOURNAL

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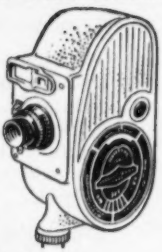

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THE ASCENT OF EVEREST. *By Colonel Sir John Hunt, Sir Edmund Hillary, and M. H. Westmacott. Joint meeting with the Alpine Club. Admission by special ticket only.*

Monday October 26 *at* 2.30 *p.m.*
THE PROVISIONING OF EXPEDITIONS IN THE FIELD. *A Symposium. A meeting with the Nutrition Society including contributions on polar and tropical rations; and on high altitude diets by Dr. L. G. C. Pugh of the* 1953 *Everest Expedition.*

Monday November 2 *at* 3 *p.m.* At the ROYAL FESTIVAL HALL.
THE ASCENT OF EVEREST. *By Colonel Sir John Hunt, Sir Edmund Hillary, and A. Gregory. Joint meeting with the Alpine Club. Admission by special ticket only.*

Monday November 9 *at* 5 *p.m.*
ECONOMIC DEVELOPMENT IN FRENCH AND SPANISH MOROCCO. *By J. M. Houston.*

Monday November 16 *at* 5.30 *p.m.*
DESERTS OF ARIZONA AND CALIFORNIA. *Kodachrome films with commentary by W. G. V. Balchin and N. Pye.*

Monday November 23 *at* 8.15 *p.m.*
NEW LIGHT ON LIVINGSTONE'S LAST JOURNEY. *By Professor Frank Debenham.*

Monday December 7 *at* 5.30 *p.m.*
JOURNEY IN SPAIN. *Kodachrome films with commentary by John Chear.*

Monday December 14 *at* 8.15 *p.m.*
INSIDE BORNEO. *By Tom Harrisson.*

Monday December 21 *at* 5 *p.m.*
OHTHERE'S NORTHERN VOYAGE: CWENAS AND LAKES. *By Professor Alan Ross.*

Christmas Meetings for Children

Monday December 28 *and Wednesday December* 30 at 2.30 p.m.
THE ASCENT OF EVEREST. *By Sir Edmund Hillary, Wilfred Noyce, and George Lowe. Admission to these children's meetings is by special ticket only.*

Exhibitions

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From December 28 to January 17 inclusive, there will be an Exhibition of photographs and equipment from the 1953 Everest Expedition, in cooperation with the Alpine Club.

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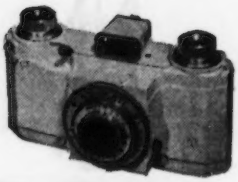

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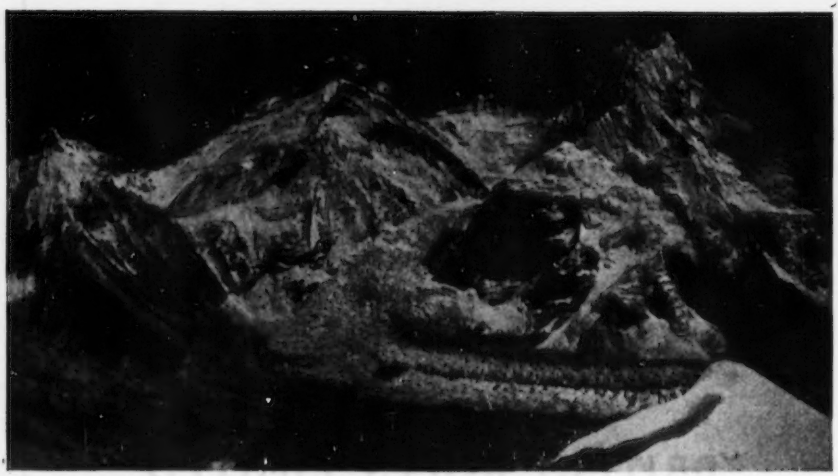

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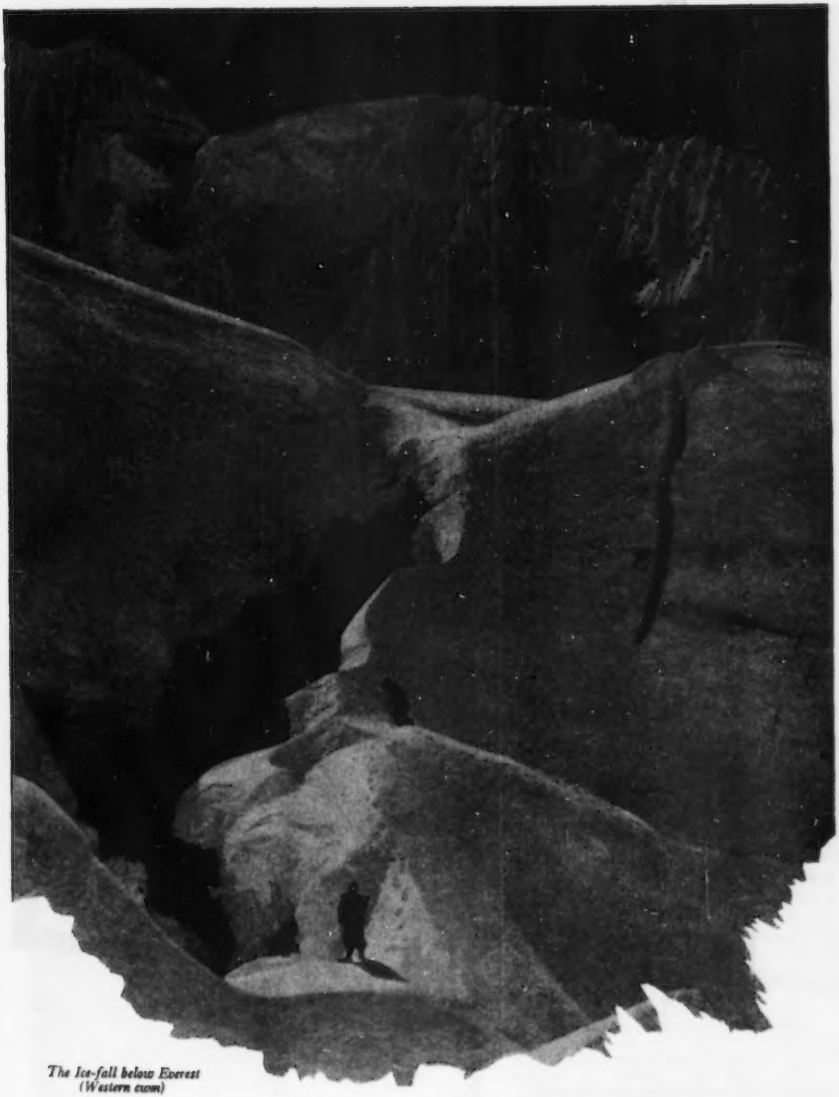

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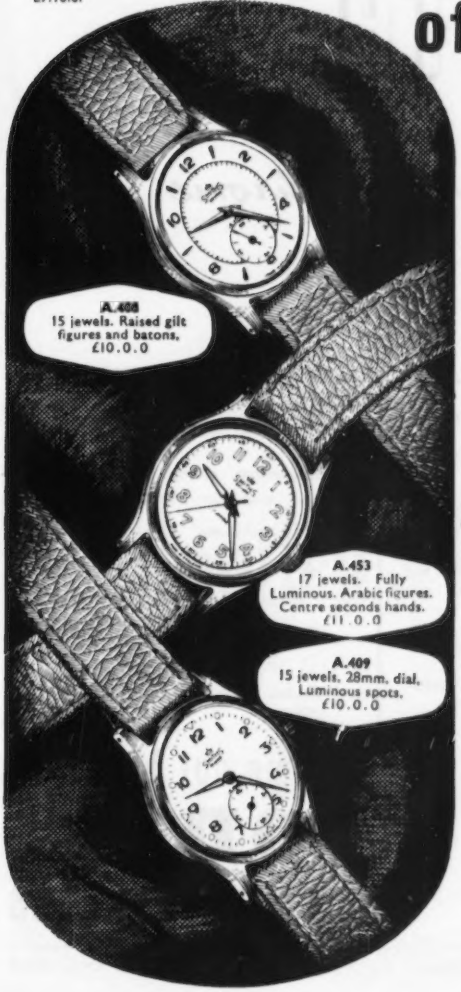

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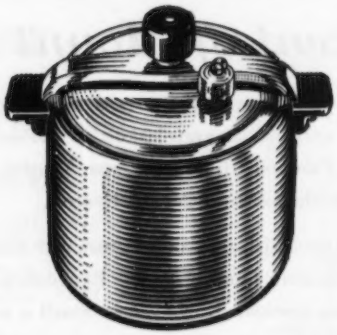

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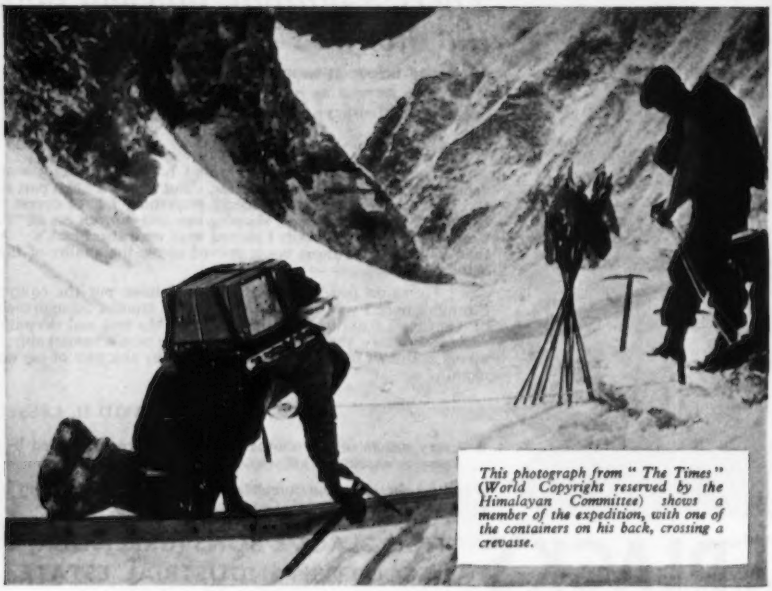

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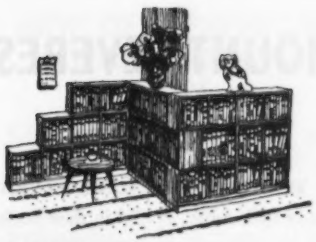

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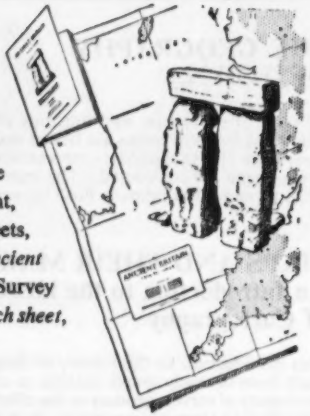

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The
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Vol CXIX Part 3 *September 1953*

THE PRESIDENTIAL ADDRESS, 1953

J. M. WORDIE, C.B.E.

IT IS MY first and sad duty in this year's Presidential Address to refer to the death in April of Her Majesty Queen Mary. Queen Mary became a Patron of the Society shortly after her visit here with King George V in 1932. Since that date she had always taken a special interest in our wellbeing, and had on several occasions visited the Society's House. From time to time she made presentations to our collections, and I should more particularly mention the two eighteenth-century miniature globes which have been on exhibition in the Map Room. We share the nation's grief at Queen Mary's death and the passing of a great Queen.

As in former years we have to record the losses which the Society and geography have suffered during the last twelve months, and these I regret to say have been especially heavy in the past year.

Colonel Sir Charles Arden Close, F.R.S., formerly Director General of the Ordnance Survey, first joined the Council in 1904; acted as one of the Honorary Secretaries from 1908–1911; became a Vice-President in 1921, and President from 1927–1930. He will be remembered as having been President at the Centenary Celebrations in October 1930, when the new lecture hall in which we meet to-day was opened by His Royal Highness the Duke of York, later His Majesty King George VI. Sir Charles was actively associated with the planning of the new buildings, which have not only given us our own lecture hall, but also very much extended the space available for the Library and the Map Collection. Sir Charles received the Victoria Medal in 1927 in recognition of his many and varied contributions to cartography and the science of map projection. His scientific standing was everywhere acknowledged and as a keen supporter of the International Geographical Union he did much to make successive congresses a success and himself presided with distinction at the Amsterdam Congress in 1938. Throughout his long life he did much to advance the work and prosperity of our Society, and at the same time his life's work has promoted geographical studies throughout the world.

Sir John Chancellor began his career as a soldier; saw much active service; passed the Staff College; and became Assistant Secretary (Military) to the Committee of Imperial Defence. He was later to attain distinction as a

Colonial Administrator, as Governor in succession of Mauritius, Trinidad, and Southern Rhodesia; and lastly as High Commissioner in Palestine from 1928–1931. He joined our Council in 1933, was a Vice-President from 1935–38, and Foreign Secretary from 1941–48, and throughout this long association the Society has benefited very much by his help and advice.

Professor C. B. Fawcett completed his twenty-one years of tenure of the Chair of Geography at University College, London, in 1950. He was one of many inspired by Sir Halford Mackinder; he made fundamental contributions to the present recognition of geography in schools and universities, and as an economic geographer he encouraged many others in their various researches. He became a member of Council in 1929, was particularly active on the Research Committee and the Library Committee, and became Vice-President in 1949.

Among other academic geographers we have to record the deaths of Mr. John McFarlane, formerly Reader in Geography in the University of Aberdeen; of Dr. H. J. Wood of King's College, London; of Mr. F. W. Morgan, of the London School of Economics; and of Mrs. Anderson, formerly Miss Margaret Willis, a prominent member of the Cambridge Geography School.

Sir Ernest Wilton, who was a member of Council from 1937–1943, had a distinguished career in the foreign service, mainly in China, and latterly in the Baltic States. Among other assignments he took part in Sir Francis Younghusband's historic mission to Lhasa in 1904.

Sir Reginald Wingate, who was born in 1861, and died at the age of ninety-two, had been a Fellow of the Society for over fifty years. He attained distinction as Governor General of the Sudan, being appointed in 1899; and later he became High Commissioner for Egypt, from 1917–19. On his return to this country he served on our Council in 1921–22.

I should also mention Mr. S. A. Courtauld, who, although never a member of Council, took a very keen interest in our work and welfare and was one of the most generous benefactors to the Building Fund in 1930.

During the past year the Society has again continued to prosper in the many fields which we cover. The evening meetings have continued to attract large audiences, larger even than those of last year, which seemed to be the post-war high-water mark. Outstanding among the evening meetings in order of delivery were Mr. E. E. Shipton's story of the British Expedition to Cho Oyu, designed to select and train climbers for a further Everest attempt; Mr. G. de Q. Robin's account of the Norwegian-British-Swedish Expedition to Queen Maud Land in the Antarctic; Dr. Anton Brun's lecture on the Danish deep sea expedition in the M.S. *Galathea;* Dr. Wyss-Dunant's account of the Swiss expeditions to Mount Everest both before and after the monsoon; and finally, of immediate practical importance, Professor Steers' description of the disastrous effects of the east coast floods last February and his remarks on some of the problems raised. Of the above Dr. Wyss-Dunant's and Mr. Shipton's papers were of special importance in the light of this year's full-scale British assault on Mount Everest.

The afternoon meetings this year represent as usual the scientific interests which we encourage. Of special importance was the meeting on "The depth of

polar ice caps" addressed by Mr. Robin in English and by M. Holtzscherer in French. One should also mention the paper on "The problems of land use in the Dry Zone of Ceylon" given by Mr. B. H. Farmer, recipient of this year's Gill Memorial; and also Professor de Béthune's contribution on "Appalachian relief" which led to a very lively and interesting discussion in which both Belgian and English geographers and geologists took part.

The film meetings continue to be popular; and in addition to the regular film meetings seven times a year there are now two evenings set apart each session in which films of particular interest to geography teachers are selected for exhibition. These two extra meetings have fully justified their inclusion in our annual programme.

The Christmas lectures to children were again highly successful, and on this occasion both lectures had to be repeated. Our thanks are due to Commander Ritchie of the Hydrographic Department who spoke on the oceanographical explorations of H.M.S. *Challenger*, and to Dr. Chesterman who spoke on his under-water films, for their cooperation in being willing to repeat their lectures on the same afternoon with only half an hour's interval.

As in former years, the Christmas Exhibition was another popular feature. This year the subject was Oceanography and the exhibition was organized with the cooperation of the National Institute of Oceanography and with the help of numerous other organizations, of which the principal were the Institute of Navigation, the British Museum (Natural History), and the Hydrographic Department. The opening of the Exhibition coincided with the discovery of the coelacanth fish by Professor Smith; and this, and an excellent broadcast on the Exhibition on the Home Service conducted by Mr. Wynford Vaughan Thomas, may have contributed to the very large attendance. The Exhibition remained open to the public until the end of January and in all was visited by more than eight thousand people.

The most prominent event in our domestic affairs has been the necessity to raise the annual subscription. I referred to this in my Address last year and pointed out that the curtailment of our activities had reached a state at which further income had become absolutely necessary if we were to continue to hold our place. A Special General Meeting was held last October and it was then agreed that the subscription should be raised from £3 to £4 per annum and that the entrance fee should be reduced from £5 to £4. There was general concensus of opinion at the Special General Meeting that the increase was inevitable; and it is gratifying to record that the Fellows supported the Council on the course taken. At the Special General Meeting steps were also taken to make it possible for Fellows to pay their annual subscription under a covenant. Many I am glad to report have done so and what the outcome may be depends now on the action of the Inland Revenue. Should this be favourable we can expect a still further increase of income.

The number of Fellows is higher to-day than it has been since 1931. We hope therefore that the result of the increased subscription will be such that we shall no longer be faced with a deficit, as was the case during the last two years, but that we can now count on a surplus sufficient to restore our activities and to make such developments as we think best in the interests of the Society. Among the developments contemplated I hope will be the

Journal, which is still less than half the size it was in 1939 and which, if our Society is to have the same attraction for the great body of Fellows both at home and abroad who are unable to attend our meetings, must be appreciably increased in size.

Among special publications this year I should like to report that Mr. Crone, the Librarian and Map Curator, has now completed his study of the Hereford *Mappa mundi* and that the facsimile reproductions have reached the proof stage and will shortly be on sale. The price will be a moderate one owing to the generous action of one of our Fellows who prefers to remain anonymous. May I recall that the work on the Hereford map originated in 1947–48 when Lord Rennell, himself a Herefordshire man, was President, and that it was owing to his interest and vigour that steps were taken to have the map brought from Hereford to London for cleaning and overhaul at the Society's expense. This gave an opportunity, with the concurrence of the Dean and Chapter, for Mr. Crone's intensive study of the map. It has now been returned to Hereford and is again on view in the Cathedral, but in a better position and in a new oak case supplied by the Society.

The second of the Research Memoirs has now appeared, and takes the form of a monograph on the origin of the Broads prepared by Dr. J. N. Jennings. A third Memoir is also in active preparation by Mr. W. V. Lewis and will deal with glacier studies in Norway undertaken by Mr. Lewis and his associates in 1951 and 1952.

Among Committee activities particular mention should be made of the work of the Education Committee over which Mr. Leonard Brooks presides. During the year they have, among other matters, discussed the quality of geography broadcasts to schools, and made various important suggestions. The Committee have also pressed for the establishment of a Department of Geography in the University College of the West Indies, and we have been assured that this will be considered sympathetically as soon as conditions permit.

The re-furnishing and re-decoration of the Society's House which was undertaken some years ago will it is hoped approach completion this summer. You will all have noticed that in spite of the war and the increased cost we have been able to maintain a high standard of decoration. Attention should be drawn particularly to the Tea Room, which has become a meeting place for Fellows. In the Lecture Hall we have taken a step forward by the introduction of a new loud speaker system which has proved most effective. A still further improvement has been the decision to purchase two 16 mm. sound projectors of the most up-to-date kind. Not only will the afternoon film meetings benefit by having two projectors, but all the other meetings will do so as well. The additional projector will enable us to have a continuous showing; before it is installed certain structural changes in the soundproof projection box must be made, and it is hoped this will be carried out this summer. I should like to take this opportunity of thanking the staff of the Society for the satisfactory work which has been carried out in all departments and for the help and enthusiasm which they have shown throughout the past year.

Before leaving home affairs and the Society's House I should like to say

that after many years we are about to carry out the much desired project of erecting a statue in memory of David Livingstone. The idea that Livingstone should occupy the niche on the outside north wall of the Hall originated with Admiral Sir William Goodenough, but it was not until two years ago that we felt that the matter could be actively pursued. The cost has been defrayed from the proceeds of a fund established in the first instance by Sir Henry Stanley and the Society, to keep the Livingstone memorials in Africa in good condition. These have now become the responsibility of the colonies themselves, and the Society felt that the capital sum thus set free could have no better use than to be applied as the nucleus of a fund for a Livingstone statue on our building. We have received a most generous contribution from Lord Catto. After consultations with the Royal Society of British Sculptors Mr. T. B. Huxley-Jones was finally selected as sculptor and the statue, which measures approximately 8 feet 6 inches in height, is now in the process of casting.

The chief international event last year was the Geographical Congress in Washington in August, which was attended by Mr. Brooks and myself as representatives of the Society. The Congress and the accompanying excursions were most successful; and it was gratifying to see so many British geographers—largely owing to the generous action of various bodies in the United States—able to journey overseas. The next Geographical Congress will take place in Rio de Janeiro in 1956 under the Presidency of Professor Dudley Stamp. Before that date, however, the other great International Union with which we are associated, that on Geodesy and Geophysics, will meet next year in Rome. Its last meeting was in Brussels in 1951, and already steps are being taken for substantial contributions from this country.

I should also add that among other events our Foreign Secretary, General Sir James Marshall Cornwall, represented the Society at the 75th Anniversary Celebration of the Geographical Society of Madrid in October last year; that our Honorary Secretary, Dr. Hindle, was present last month on our behalf at the 50th Anniversary of the Geographical Institute, Liege; and that the Director and Secretary, Mr. Kirwan, has just returned from a similar function celebrating the 75th Anniversary of the Royal Geographical Society in Antwerp.

We continue to make grants from our funds not only to the large important expeditions, such as the North Greenland and Everest Expeditions, to which I shall shortly refer, but also to the many smaller ventures led by private individuals, most of them sponsored by different Universities. In the main, help for the latter comes from the Universities concerned and from the individuals themselves, but also, though only at present to a small extent, from the Society itself. It is the Council's hope that we may be able, as our financial position improves, to make these grants larger. This year no less than nine expeditions have been supported by the Society for work during the Long Vacation in Spitsbergen, Iceland, Norway, Ethiopia, Uganda and Tanganyika. May I also take this opportunity of mentioning a novel venture during the summer of 1952—namely the party of schoolboys from Sherborne led by Mr. Tom Wright which was able to visit Spitsbergen.

The British North Greenland Expedition, which established its base in

the late summer of 1952, is now in full swing. Its great achievement this spring has been the transfer of seven out of eight weasels from the outer coast, across the 20-mile-wide Storstrom Glacier (Storstromen) to the base at Britannia Lake in Queen Louise Land. Unfortunately there was very little snowfall last winter (which may of course be the usual condition), and it was only after a supreme effort that Commander Simpson was able to get his weasels across the almost bare ice with its crevasses and incised channels. He has now relieved the men who wintered at the ice-cap station, Northice, and since May seismic and gravity work have been actively undertaken. In the next twelve months the criss-cross lines of soundings which will be made will link up with the soundings in the southern half of Greenland made by the French Expedition under Monsieur Paul-Emile Victor in 1950 and 1951. Together the two expeditions should therefore give a complete picture of the thickness of the ice cap over Greenland.

The year 1953 has seen the conquest of Mount Everest, a feat which must rank for all time whether as mountain adventure or as scientific discovery.

The Everest Expedition was jointly organized by the Royal Geographical Society and the Alpine Club functioning together as the Himalayan Committee, which is really the old Mount Everest Committee re-named. There is no need to recapitulate the expedition's progress. The despatches have been published in *The Times*, but also, whether supplementary or anticipatory to these, there have been innumerable rumours and false reports which were a prominent and at times amusing feature, but which must have misled many people who wished to follow the true sequence of events on the mountain. Colonel Hunt's book will appear in the autumn and there is no need therefore to go into dates and details.

I should like, however, to indicate how this year's expedition differed from those of former years. The intention of the earlier expeditions, from that led by General Bruce in 1922 onwards, was to try and reach the summit without the use of oxygen, and if this should not prove possible to use oxygen only when absolutely necessary. As a result climbers first went through a process of acclimatization, with apparently satisfactory results; in reality a marked physical deterioration had set in, and no climbers, certainly above 26,000 feet, were as we see it now in prime physical condition.

When the past history came to be summed up in the early planning stages last year it seemed evident to most of those concerned that 28,000 feet was the limit of human endurance under the conditions just described of acclimatization and deterioration. 28,000 feet or thereby had been the turning point of Norton and Somerville in 1924, of Wyn Harris and Wager in 1933, of Smythe supported by Shipton also in 1933, and finally last year of Lambert and Tensing.

It seemed therefore that some form of artificial aid was absolutely necessary, not only for the last 1000 feet but at medium levels as well. Any doubts on this point were finally removed after hearing the conclusions of expert physiologists on human behaviour at great heights; and how the power of thought and decision is no longer possible. In this connection tribute should be paid to Professor G. I. Finch, who was a pioneer in advocating oxygen in the

early attempts on Everest and himself made use of an open circuit system in 1924. He has consistently maintained his point of view and summed it up in a notable lecture which he gave to the Royal Institution in June 1952. It must be a great pleasure to him therefore, after thirty years, to know that his opinions have been adopted and that they have proved to have been right. The extended use of oxygen was the big change which marked the 1953 expedition.

Another feature which had been noted on past expeditions was that the rate of climbing at great heights became extremely slow, due without doubt to the deterioration which always accompanied acclimatization.

The Himalayan Committee therefore took the view that oxygen was necessary on a very much bigger scale than formerly, that it was in fact the secret of success; and that as a consequence the oxygen apparatus and the supply of oxygen were of the very first importance in any plans which had to be made. With the active support of the Medical Research Council a Committee with Sir Bryan Matthews as Chairman met at Cambridge from time to time last summer and winter and decided various principles. An important step, for instance, made by this Committee was the decision that a face mask must be used for the oxygen intake.

The actual laboratory work on the oxygen was undertaken by three groups: by Mr. Peter Lloyd, Oxygen Controller, who was responsible as on the earlier Cho Oyu expedition for the open circuit apparatus; by Dr. Bourdillon and his son, Mr. Tom Bourdillon, on a closed circuit apparatus; and by Mr. Campbell Secord on an entirely different process depending on chemicals. From the first reliance was placed mainly on Mr. Lloyd's traditional open circuit apparatus, but it was hoped that the more experimental Bourdillon sets might also function, as in fact they did. I should like specially to thank Mr. Lloyd for all he has done to lighten and improve the oxygen equipment, and to convey to him our congratulations on the satisfactory outcome to his efforts.

This, then, was the strategical plan as decided by the Himalayan Committee—(1) dependence on oxygen and (2) size of the party to be determined by the number of attempts to be made and by the amount of the oxygen carry to great heights which could be made by the climbers and the porters.

Colonel Hunt's appointment as leader was made in September 1952. He at once started to work out a scheme for the assault and to estimate the amount of oxygen which would be required to carry out what he had in mind; and by the end of October his plans were ready to submit to the Committee. These involved, as far as the oxygen was concerned, a very heavy lift for the Sherpa porters who would have to carry a bigger load to the South Col at about 26,000 feet than seemed at all likely. The Himalayan Committee, however, felt that the full amount of oxygen required by the plan should be ordered and sent out to the Base Camp even if it should not all reach the South Col.

The type of assault planned and the amount of oxygen which had to be carried decided the size of the party. There was no question of whether the attempt should be made with a small or a large party. A small party was quite out of the question, and a large party essential to success.

Colonel Hunt's plan, the tactical plan, as it was laid before the Himalayan Committee last October was as follows: the climbers were all to become accustomed to the use of oxygen on the training climbs; the three couples intended for the final assaults, though not necessarily all members of the parties establishing the route, were to use oxygen from the advanced base in the West Cwm at about 23,000 feet; oxygen was to be used while sleeping at and above the South Col; oxygen was to be used for all climbing, both the assault climbers and the supporting men, above the South Col. In the event oxygen was used much lower down the mountain than ever in the past, and in all probability was used, even though in small amount, by some climbers from heights below 20,000 feet.

What mattered was that this year's apparatus, thanks to Mr. Lloyd and Dr. Bourdillon and their helpers, was substantially better than any pre-war set and that oxygen was provided in very much greater quantities than had ever been done before. The quality of both sets of apparatus must have been of a high order.

In all probability deterioration was checked though not removed. On the the final climbs Bourdillon and Evans on the reconnaissance assault and Hillary and Tensing on the successful climb appear to have left the South Col climbing as fit men at a fairly rapid rate. Evans and Bourdillon were climbing apparently at a rate of 500 feet in an hour. You will have noted from the press reports how both parties were able temporarily to remove their oxygen apparatus both on the south peak, reached by Bourdillon and Evans, and by Hillary and Tensing on the actual summit. This appears to be evidence that the climbers were by then acclimatized to high altitude breathing but without the evil effects of deterioration. There is practically no mention of deterioration in the press reports, which may be explained by the fact that in general no one was living and climbing for any length of time above 23,000 feet without some oxygen. Mr. Peter Lloyd tells me that he has already had a letter from one of the climbers which makes this clear; the writer goes on to say that in establishing the South Col camp he actually gained real enjoyment from the climbing.

I have spoken in this way as it has been said that a large step towards the conquest of Everest was achieved by careful planning in this country. What I have said above bears this out, but apart from the first decisions of the Committee the home planning was entirely in Colonel Hunt's own hands, and he was justified when he said on his departure that probably the doubtful element after the Expedition reached its base would be the weather in the last two weeks of May.

It has also been asked in many quarters how far the present success can be attributed to former expeditions. That this is the case is obvious, and I would particularly emphasize Mr. Eric Shipton's belief that a route might be found from the south and his successful reconnaissance from Nepal of the beginnings of that route in 1951. One must also mention the Swiss achievement in climbing the Lhotse face; but in fact all the forerunners have contributed in some way, beginning with Colonel Howard-Bury's reconnaissance in 1921, followed by the big assault expeditions led by Brigadier-General Bruce in 1922 and 1924, by Mr. Hugh Ruttledge in 1933 and again in 1936;

by Mr. Shipton's reconnaissance from Tibet in 1935, and by Mr. Tilman's assault party in 1938. All these expeditions contributed something and built up an experience among English climbers which gave us a very considerable advantage. Personally I think the decision to try a southern route should be emphasized, and credit given to the climbers concerned, who were prepared to take a chance from Nepal by an entirely different, and at that time rather unpromising, direction.

I have spoken at some length about Everest. Success came on us almost unawares. A new technique of oxygen climbing has been established. Further developments in improving the apparatus and in the use of oxygen for climbing are almost certain. The Everest ascent has broken down the prejudice against it, small as it had recently become, and we now know that the use of oxygen is a natural and welcome aid in high altitude mountain climbing.

THE FIRST SWISS EXPEDITION TO MOUNT EVEREST, 1952

ED. WYSS-DUNANT

At the beginning of 1952, the problem of the south route to Mount Everest presented itself in the following terms: our first task was to master the ice-fall of the Khumbu Glacier which rushes down between the western ridges of Everest and of Nuptse, covering a difference in level of 800 metres. The Anglo-American reconnaissance of 1950 led by Tilman and Shipton's British Expedition of 1951 had prepared the way. Our second task was to explore the unknown West Cwm and to place there Camps III, IV and V. Thirdly, we had to reconnoitre the best approach to the South Col up the precipitous 1000-metre slopes; and finally, there was the assault on the summit of Everest itself, by way of Camp VII which we hoped to establish on the south-east ridge of the mountain.

Such were the different aspects of the problem, complicated by all the unknown elements of glaciology and meteorology. In order to secure the success of the expedition it was necessary to take advantage of the latest improvements in equipment, and those points of our organization which seem to me particularly important and of special interest will be found summed up in the Appendices.

Taking it for granted that most people interested in Everest are already familiar with the reports of the American and British reconnaissances of 1950 and 1951, I shall merely recall them in a few words. The first American expedition was carried through rapidly in thirty-six days: starting from Biratnagar, the climbers took off from Namche Bazar and reconnoitred the Khumbu Glacier as far as the foot of Pumori and up to the great ice-fall of the West Cwm. The second post-monsoon expedition, the Everest Reconnaissance led by Shipton in 1951, started from Jaynagar and pushed the exploration further by crossing the Khumbu ice-fall as far as the entrance of the Cwm where the great crevasse put a stop to further ascent.

Starting on March 29, the Swiss Mount Everest Expedition, including 165 coolies and 12 Sherpas, arrived in Namche Bazar on April 13. Here the coolies were disbanded and porters from Namche were engaged to forward the loads to the Base Camp. The Base Camp was established and the whole column had arrived by April 23. Here we found traces of *yeti*, or "abominable snowmen," of which we can give the following account.

The "Abominable Snowman"

On April 18, the snow still covered the moraines from a height of 4500 metres along the Khumbu Glacier. A heavy fog hampered the observations of the patrol which was sent to reconnoitre the exact spot of the Base Camp, and it came back without realizing that it had unwittingly put to flight the mysterious being which haunts the mountains of the Himalaya. There it was that I discerned traces crossing the icy surface of a small frozen lake, and on

the same evening Professor Lombard arrived at the Base Camp announcing that he had followed *yeti* traces for a long way. These traces all came from the West Col, which we dubbed the "Yeti Col," and which connects the Lobje Valley with the Western Valley. We began by examining the traces on the frozen lake. They were somewhat blurred and much smaller than those we followed afterwards in the valley towards the col. I then discovered several tracks, three of which were undeniable, and of which we took the measurements. The plantar surface was 25 to 30 cm. long (according to the age of the specimen) and 12 to 15 cm. wide, which corresponds to the dimension given by Shipton; the traces on the lake did not exceed 20 cm. in length. The stride was 35 cm. long and the steps absolutely rectilinear. The depth of the track indicated an animal of good size but not enormous, and we reckoned the weight of the beast to be between 80 and 100 kilos. On examining the tracks closely, although they had been altered by wind and by snow fallen between April 18 and 23, you could distinguish five toes, only three of which showed claws. The thumb was generally turned backward and deeply marked; on two tracks I noted at the back of the heel two triangular imprints, probably of tufts of hair. We finally stopped before an obstacle in the animal's path, a rock behind which was the deep mark of three paws close together, the fourth being suspended for the next jump over another rock. Beyond this, the same traces of three paws together recurred, while the fourth marked the first stride. The track that followed was rectilinear. Farther on, I saw three tracks, one coming from the moraines and the others from the vale; they met and continued as though a single animal had pursued its way. These *yeti* are true alpinists, walking in each other's footsteps.

The following conclusions can, I think, be drawn:

(*a*) We have to deal with a quadruped: this is proved by the jump over the rock.

(*b*) The *yeti* doesn't live alone, but in a family: the converging tracks, the footprints of different size confirm this, as does the track on the lake which indicates a young specimen.

(*c*) Its weight may be reckoned at about 100 kilos.

(*d*) The footprints belong to a plantigrade with five toes.

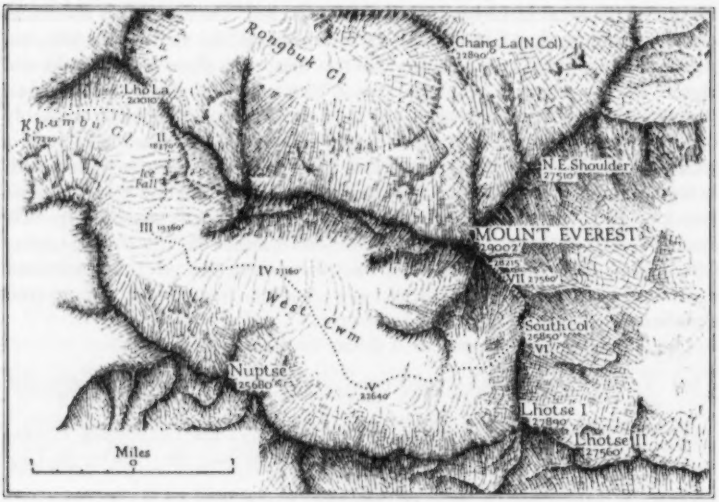
(*e*) Behind the footprints are found, in certain specimens of evidently adult footprints, the double triangular mark of tufts of hair. This last mark, not without importance, is not visible on the excellent photograph of the fresh track taken by Smythe, nor on Shipton's photograph.

I could find no trace of meals, nor yet of excrements, and this confirms the hypothesis that the animal is only passing through and that it does not frequent these heights; we should at least have found a place of refuge if not a lair if the *yeti* was living and hunting in the neighbourhood. I rather think it passes over the cols only when, having scoured one valley, it tries to reach another. This bear is a wanderer, avoiding the zones inhabited by men and making for the high altitudes haunted by the panther—a wild beast of which the *yeti* appears to have no fear. I don't think one can say more. The information given by natives is always inconsistent, and it is difficult to distinguish legend from reality. Let us therefore await patiently the day when

explorers will come back with photographs of the beast itself or, maybe, the very skin of the bear *ursus arctos isabellinus*, according to the conclusions of the late P. E. Pocock of the British Museum.

Into the West Cwm

On April 27, we climb to Camp I, following along the Khumbu Glacier—that marvellous Valley of Ghosts which is really a wide alley through ice pinnacles. The indefatigable Dittert is again ahead, patrolling with Chevalley, Aubert and Lambert. He has spotted the place for Camp II, and already seeks to penetrate the ice-fall at a point in the middle of the Glacier. But they are obliged to give up this approach and come back on their tracks. We work to



Approach to Mount Everest by the West Cwm

meet them (Roch, Flory, Hofstetter, Asper and I) carving and improving the track to Camp II up to the ledge at 5600 metres where the Camp is to be established.

On April 28, Roch, Flory, Hofstetter and Asper set out on patrol. They choose the left-hand path to take them out of the seracs, that is to say the right bank of the glacier, despite the danger of avalanches from the western arête of Everest. Just beyond the seracs, not far from the rocky spur of the western arête, yawns a gaping crevasse, six or seven metres wide and twenty metres deep, which bars the way to the famous West Cwm. Roch does not hesitate: he decides to make a rope bridge. To do this, the point of least resistance is chosen and Asper lets himself slide down to the bottom of the crevasse. Then, cutting and climbing, he manages to climb up the icy slope and to instal himself firmly on the other side. The obstacle is overcome: nothing remains but to drive in posts and to fix ropes to them; from now on

West Cwm from the Lhotse face

everyone and everything will pass over this improvised bridge and those Sherpas who hesitate at first will soon be clambering over with smiles.

Camp III is established on April 30, and the Cwm is open to exploration. Glorious sight—the valley stretches before us between the western arête of Everest and the ridge of Nuptse, sparkling with crystalline ice! At its far end, the Cwm is closed by the 8501-metre height of Lhotse which merges with Everest by the sweep of her arête on to the South Col, and with the ridge of Nuptse on the other side. This icy basin runs to about five kilometres in depth, and we have called it the Valley of Silence. The powdery avalanches founder without rumble or roar, and the stones roll down the flanks of Nuptse with no more than a plaintive whistle. Day after day, the columns of porters bring supplies from Camp I to the crevasse; three blasts on a hunting horn announce the deposit of the loads at the point from where Camp III will take them over. The best time for the coming and going between Camps I and III is from seven to eleven o'clock in the morning. The thunder of the avalanches which follows the nightly freeze-up ceases suddenly at five in the morning, and in the solemn silence which supervenes the porters set out, making the best of a lull which breaks around midday when the din of the avalanches begins once more. The snowfalls on the western arête of Everest, on the vulnerable stretch of the track from Camp II to III, choose their time discreetly: one fell half an hour before a column had passed, another half an hour after.

On May 9, Roch, Aubert, Lambert and Asper establish Camp IV at 6450 metres at the far end of the Cwm, and on May 10, Flory and Asper achieve the base of the Lhotse glacier from which successive reconnaissances are to set out; on May 11, Aubert and Lambert bivouac at the spot chosen for Camp V. Gradually, Camp I empties itself, just as did the Base Camp.

On May 14, most of the equipment is carried up to Camp V (6900 metres) and I set out myself, with Sarki and Gyalzen, for Camp IV. The weather is beautiful this morning, but soon we are caught in the usual afternoon showers which worsen into a storm as night draws on. I find Hofstetter at Camp III, and next day we are able to follow through glasses the two patrols which, at the end of the Cwm, are making their first sally towards the South Col. They have taken the Lhotse corridor and are skirting the right bank of the glacier of the same name. They advance slowly, avoid the rocky arête of the Éperon des Genèvois which must be sheeted with ice, and, making height all the time, attain to 7450 metres. Having consulted together, the patrols come down again.

Next day, May 16, I leave with Hofstetter for Camp IV. How magnificient is this approach to Camp IV between the giant peaks! Straight ahead of us, the wind sweeps away an avalanche of dusty snow before it can fall. It would be like fairyland were it not for the whine of the cascading stones. Where do they fall, I wonder? There is not the faintest trace of them in all this soft snow. We plod on more and more slowly through the shifting snow and after what seems an interminable spell we come up with Chevalley, Aubert, Flory and Asper at Camp IV.

By good luck, our walkie-talkie is working today, and I am able to make contact with Dittert, and then with Dr. Chevalley at Camp V. "At first it

West Cwm and Lhotse

was merely tiring in the snow, then the cutting of the way became exhausting and we had to give up" Dittert tells me, and "We are trying the left corridor tomorrow." "We are all in good health," Chevalley assures me. Tomorrow I mean to try the closed circuit type of oxygen equipment on the same journey as to day from Camp II to Camp IV. The benefit of this sytem of continual inhalation is shown by the shortening of the time taken by 25 minutes; say, 30 per cent. improvement in climbing power. I am doubtful whether the equipment which is adjusted to intermittent inhalations can, owing to inadequate suspension and the absence of a mask, do as well at 8000 metres.

Today, May 17, I see as I proceed Dittert, Lambert, Aubert, Chevalley and Tensing, cutting across under the rocky arête of the Éperon des Genèvois and exploring the left-hand corridor. At −20° Centigrade, they have to cut steps in the solid ice, and presently they retrace their way to climb once more on the old track diagonally along the rocky arête. They reach 7600 metres. On May 19, a new attempt takes Chevalley and Asper, roped together, up to 7800 metres, and they descend in a loop on the glacier of Lhotse; meanwhile, Flory and Aubert explore without much progress the seracs of Lhotse's western flank. There remains no alternative but to revert to the attempt of May 15, furnishing the worst transits with ropes fixed along 150 metres, which enables us on May 21 to establish a depot at 7400 metres. But on May 22 and 23 the wind unleashes its full blast, and the team which leaves with high hopes on the 24th finds the way blocked by a tempest of snow. It seems that the elements are doing their utmost to keep us from climbing the South Col. The happiest member of the party, for the present, is the botanist Zimmermann who came up to surprise us, and who has discovered at 6400 metres near Camp IV, on an open moraine, some minute plants of arenaria and androsace. This establishes a botanic record in height.

At last, on May 25, a team composed of Lambert, Flory, Aubert and Tensing decide to force their way up Everest. The narrative continues in Lambert's and Dittert's own words.

The first assault: Lambert's narrative [1]

"The morning was exceptionally clear and no plume showed on Everest. Flory, Aubert, and I set out accordingly with the Sherpas Tensing, Pasang, Danamgyal, Phu-Tarky, Ang Norbu, Mingma Dorgi and Ajeeba.

"Slowly we climbed the spur again and went obliquely on in tracks already made by Chevalley and Asper, bending back along the centre of the couloir leading down between the Spur and Lhotse, over patches of snow and small rocky ledges. Hours passed. The sun began to sink, the wind rose, and at about 25,260 feet two of the Sherpas, Mingma Dorgi and Ang Norbu, turned to descend, afraid of frostbitten feet. There was nothing to be done but divide up most of their baggage. Flory and I each took a 13-pound tent, Aubert a sleeping bag. Unluckily the sleeping-bag slipped from his hands in the wind and rolled down the slope to be lost for ever.

"The situation was becoming critical. The sun sank behind Pumori, and as it disappeared the wind and cold increased. At seven p.m. we arrived just in

[1] Abridged version of Lambert's and Dittert's reports in 'The mountain world, 1953.' Allen and Unwin, Ltd., London.

time at a depression in the snow less steep than the surrounding terrain. The four Sherpas dug a platform for a tent on one side, and on the other Flory and I prepared the ground for our tent, while Aubert held tight on to the packs on the slopes. We squeezed into our tents, and then began a fearfully cold night in an extremely hazardous position. It was impossible to stretch our legs, in fact we dared not move for fear of rolling with the tent to the bottom of the couloir. The three of us lay still roped together and wearing crampons and it was impossible to spread out a mattress or sleeping bag. Our plight was not encouraging for the continuation of the assault, for the night merely caused so much extra fatigue.

"It was a long and dreary night and we shivered as we waited for dawn. I had fixed my ice-axe at one side and passed ropes underneath it in order to safeguard us in case the tent, buffeted by the wind, should be blown away down the slope. Dawn broke at about six o'clock, Nuptse became clearer, and the sun appeared at the bottom of the valley towards Pumori. As soon as it touched our slope we began to fold the baggage and roll up our tent. The Sherpas also got ready, but were not feeling well. Two went down to retrieve some of the supplies left en route, but Tensing who throughout had shown outstanding courage and dynamic qualities, continued with us. We climbed with our muscles stiff and cold towards 26,250 feet and arrived at last on a hump of ice facing the peak of Everest with Lhotse behind. Below us the South Col was swept by a relentless wind which left nothing but the stones. After Tensing had fetched up the rest of the supplies, and also induced the three Sherpas to rejoin the party, we managed, with difficulty, climbing in that terrible wind, to get our two tents up to the col. We had to crawl about on all fours, wearing crampons, to establish the camp. The wind continued murderously fierce, but we rested a little in the shelter of the tents. The altitude was affecting the young porters; Pasang wanted to die on the spot, Phu-Tarkey zigzagged about as if drunk and Danamgyal had a headache. This meant that our Sherpa team was finished, for the next day it would have to retreat, instead of bringing up more supplies to set up a camp at 27,560 feet. There was nothing to be done about it. Despite the wind which battered the canvas, we had a better night, and on May 27 the four of us moved off towards the base of the south-east peak of Everest, at the foot of a great rocky slope; in two hours we reached a little col at 26,296 feet and had a magnificient view of Tibet. A projection resisted our efforts to surmount it; Flory pushed on a little further, but the slope was too steep and any idea of climbing it had to be given up. Retracing our steps, skirting along the base of a spur falling to the South Col, we approached a wide couloir, which was easily climbed between rocks and snow. Then the couloir narrowed and soon we found some easy ledges on the right. After a rest we decided to open a canister of oxygen, Tensing and I, while waiting for the other two. It revived us, but only for about twenty minutes. I took the lead again over rocks, then over rocks mixed with snow, and at about three in the afternoon I was astonished to find myself on the arête of Everest itself, at the summit of the first spur leading from the small col. There was a sensational view over Tibet and the east face of Everest tumbling 16,000 feet down into Karta valley. Farther away were the small rounded mountains of Tibet. Lhotse behind us had receded, for

we had almost reached the level of its summit; Nuptse looked very small in the west. This was a moving and impressive moment.

"Tensing suggested—just as I was thinking the same thing—that we should sleep there in the tent he had been carrying since morning and make an assault on the summit the next day. I agreed, in spite of the absence of a mattress or sleeping-bag. The opportunity was there and we had to take it for the sake of the expedition. Both of us were in luck, for our physical condition was good, and so were our heads.

"When Flory and Aubert arrived we discussed it with them, and as it was a delicate situation we spoke frankly. It was eventually agreed that Aubert and Flory should return to Camp VI on the South Col and await our return. At four p.m. Tensing and I established ourselves in our ice-pit. Then followed another terrible night, which we spent slapping one another to maintain our circulation, with nothing to drink except some snow melted with the help of a candle. We had a little food, and we had the cold.

"At long last the dawn of May 28 broke, and we emerged from the tent absolutely frozen, but to our disappointment great clouds were rolling over Nuptse and there was a west wind. Over Tibet it was fine and clear. We set off at about six o'clock with three canisters and some food, and slowly we climbed, making use of snow and easy rocks. Fog and snow hampered our advance, but we climbed on, conquered two ressauts, then came to a zone of cornices connecting up to the top of the south summit. We crossed these ledges, again sinking in snow to our knees and making tracks in relays. It was heavy going—three steps and then a halt for breath. Snow was falling, but from time to time the summit cleared, and we peered up at the last forbidding heights.

"What were we to do? Wind and snow threatened us with further hardships. We were near the last rocks before the final pyramid, but the weather was deteriorating and common sense urged us to turn back. We took a little more oxygen. But I can record that at 28,215 feet I was in good condition, except for a deceptively pleasant sense of well-being.

"When I stopped I felt magnificent. That is perhaps the most fateful moment at this altitude; everything seems to be going very well, and at precisely that moment one fails. Tensing, too, had moments when his balance seemed uncertain. Happily we always kept our heads; we were aware of our position and of what we were doing. The oxygen helped, but it was impossible to pump it in while moving, and when we stopped its effect lasted about 20 minutes and then we relapsed.

"We decided to descend. Tracks recently made had almost completely disappeared, and we had to stop as often coming down as going up. Down on the South Col, Aubert and Flory came to meet us in a state of great anxiety and got us into the shelter of Camp VI. Tensing was by this time half dead with fatigue, and for the rest of the day he had continually to be awakened and forced to drink. He slept motionless until next morning."

The Second Assault: Dittert's narrative

"Lambert's party left for its attempt on the summit on May 25, and now, on the 29th our team, composed of Dr. Chevalley, Roch, Asper, Hofstetter

Camp I, Khumbu Glacier

Reconnoitring the Ice-fall on way to Camp II

Rope bridge across 30-foot wide crevasse beyond Camp II

and myself, leaves in its turn to climb the South Col. We expect to meet the returning members of Lambert's team, which we know to be reduced to four, their other Sherpas having rejoined Camp V on the evening of May 27 in a state of extreme exhaustion. There is a sudden cry of "There they are!" and there to be sure are our four comrades, slowly approaching the crest. They reach it at last and we hasten to join them. We embrace each other, but to our consternation we discover that they have reached the limit of their endurance. Tensing, worn out by his exertions, can hardly move and has to be helped. Aubert's eyes are sunk in their sockets and he, too, seems worn out. Briefly they tell us what they have done. They still believe that with luck we can reach the summit. I doubt it a little, but I am nevertheless optimistic, in spite of the prospect of a return in the same shape as the first group.

"As we move upwards the Sherpas in front constantly turn back to see if we are coming. We realize that they have placed their lives in our hands, and this responsibility weighs on our shoulders. I tell myself that if one member of the party is taken ill or injured, he is lost: a man has only enough strength to look after himself. And if a storm gets up, what then? As we advance, the South Col extends before our eyes, and suddenly we see two yellow points—the tents—a hundred yards or so below, on the other side of the ridge. And at six p.m. we reach Camp VI, 25,853 feet up on the South Col.

"Next morning, May 30, we emerge from our tents to find to our surprise that Everest has assumed its great plume of snow. The sky is clear enough, but the wind is violent and icy. I spend a few minutes outside, and in a moment my hands are numb; when I go back into the tent I am very nearly frost bitten. In these circumstances, I postpone until tomorrow the climb to Camp VII. In any case, it will only be possible if the wind dies down a little, and if Everest sees fit to do without its plume. Thus we pass our third night on the Col. It is a night which drastically weakens the strongest of us, and a much enfeebled team leaves the Col on June 1 for the descent to Camp V. The first rope team consists of Mingma Dorgi, Roch, Asper and Hofstetter. Sarki is not ready, and it takes all Chevalley's energy to get him out of the sleeping-bag in which he has spent the past three days.

"The climb to the crest of the Col is very slow. Luckily the weather is calm. If it had been stormy, our situation would have been critical. Certainly a man in Sarki's condition—he collapsed several times—would have to be abandoned. In front of us is the way down, and the all-but-certain prospect of arriving safe and sound at Camp V. We are completely exhausted and are dismayed to find that the efforts necessary for the descent today are even more exacting than those we made three days ago on our way up. This shows all too clearly how a man's strength deteriorates at a height of more than 25,500 feet. Slowly we continue the exhausting descent. Never, it seems to me will we reach the buttress; but approach it we do, as the hours drag by. Just before six-thirty p.m. we arrive at the little platform of the depot. Sarki is at the end of his strength, and we decide to pass the night here. Asper, who is very exhausted, will stay with us, while Roch, Hofstetter, and Mingma Dorgi will go on to Camp V. The moon will help them, and tomorrow morning they will send two Sherpas up to help Sarki.

"We make our way to Camp V next morning, where Lambert greets us, and

next day we leave together for the base camp. It is time we did so. The crevasses are wide open, the melting seracs threatening and the route absolutely changed. Happily, Sherpas are sent from Camp I to lead us through this frightening chaos, which our leader had to manage during the whole expedition. Thus we arrive safely at the base camp on June 4. On the 9th, after a friendly meeting with the British Cho Oyu expedition in Thyang Boche, we arrive in Namche Bazar. The monsoon has broken in cataracts of rain, and the adventure is at an end."

I should like to sum up the experiences of this expedition, and to assert that the crossing of the seracs right into the Cwm is practicable in spite of the dangers caused by the instability of the seracs and the ever-threatning avalanches from the hanging glacier of the west ridge. But, I must underline that this way is easier in autumn than in spring time because of the ice conditions.

It can be also asserted that the crossing of the great crevasse is not a sufficient handicap to prevent men and material from reaching the Cwm. In the spring, however, operations must be conducted rapidly and should not run the risk of the monsoon, which would not fail to close the trap—I mean the icefall—after heavy falls of snow.

The South Col slope remains the obstacle number one; for the extremely variable glaciological conditions there might at any moment turn an expedition into a catastrophe, either because of an early monsoon or because of the exhaustion of the climbers after too long a sojourn on the South Col, which itself becomes a channel for avalanches in an excess of fresh snow and an icy surface when the snow is lacking. An intermediate camp on the slope itself at 7600 metres would present considerable advantages as a safety factor by diminishing the excessive distance between Camp V and the South Col, and would avoid the exhausting bivouacs that two columns, one on the way up and the other on the way down have had to endure. The second Swiss expedition was to undertake this task which is now accomplished, but not without great difficulties. The creation of this supplementary camp depends entirely on the snow conditions. In spring 1952 it would have needed pick-axes, perhaps dynamite to obtain an even surface on this ice slope. On the South Col, an important camp could be established, not on the saddle itself but, if possible, higher where the winds stop whirling.

At 8400 metres, the south-east ridge offers a rocky platform where you can pitch a tent as a last stage before the supreme assault; the establishment of another relay higher up would be physiologically impossible for a prolonged stay owing to the disconcerting speed at which the human organism deteriorates at very high altitudes. One may allow oneself two days of assault on starting from the South Col, but the third must be given up to the descent. On the fourth day the exhausted organism would run the risk of no longer standing the strain of walking, particularly if the weather broke.

From 8400 metres to the top no difficulty of a technical order seems likely to create a definite obstacle. The powder snow constantly blown by the wind is only deep at certain spots in the curves of the ground. 8500 metres does seems to be the physiological limit for the human organism without the aid of

oxygen apparatus; and this only in the case of one or two climbers specially fit for the effort, and not for the whole team. And it is the duty of the leader to give extreme care to the evaluation of the resistance to altitude of the climbers and their respective capacities.

The only thing to be considered is the toughness and the perfect fitness of the subject, and it is here that the age question is predominant, I may almost say a matter of life or death. The age of thirty-five is the optimum average for the greatest heights. But not only this: the leader has to manage to judge the speed of his party's relation to the time necessary for acclimatization. Our acclimatization from the Base Camp took place between April 23 and May 16 up to Camp V at 6900 metres; that is, in three weeks, which should be sufficient lapse of time. From May 10 to 15 the continual coming and going which took place between Camp IV and V, greatly helped to make adaptation easier. From May 15 to June 1 operations were conducted from an altitude of 7000 metres to the maximum height attained. Consequently, the organism was spurred on to a supreme effort during twelve days after becoming both acclimatized and adapted. I consider this to be a maximum. The proof of it is that a second assault, with the same men, above 8000 metres, was absolutely out of question without an interval of two weeks rest. In any case, the oncoming monsoon would have excluded the possibility of another trial. A repetition of the Annapurna experience must at all cost be avoided. Warned by our former experiences, we reckoned that the monsoon was due between June 6 and 10. It broke on June 9, by which time we were all safe and sound in Namche Bazar.

Now that the south route of Everest has been discovered, now that all technical data of the problem are known, the essential point is this: to succeed in diminishing the hours of march from the upper camp to the top; time that may be reckoned, without oxygen, at ten hours (45 metres per hour): as many must be counted for the return. Therefore the climb cannot be attempted without the help of oxygen apparatus, for the continuous inhaling of oxygen may at such a height increase the climbing power of man 40 per cent.

The conquest of the summit of Mount Everest has entered into its ultimate phase, but it needs such a miraculous concurrence of circumstances, physiological, meteorological and glaciological, all simultaneously favourable, that the probability of success is very small. May the British expedition achieve success; it is my heartfelt wish.

APPENDIX I

Equipment and food

I am personally convinced, since the 1949 Kanchenjunga-Pyramid Peak expedition, that ordinary mountain boots, even if improved, are not fit for Himalayan climbing. Even in former expeditions, British and others, it was clearly demonstrated that leather boots freeze in the night and that to put them on again is something of a tragi-comedy. I have had the opportunity of seeing Arctic peoples, for instance the Eskimo with sealskin boots and Samoyedes and Laplanders with reindeer boots, and these ethnological observations among the cold zone people gave us the necessary elements for fighting against frost bite of the extremities. But the original native boots would have been no use for

climbing. The solution was found by manufacturing a very light buckskin boot which could be placed inside the reindeer boots. For protecting our hands, we bought the double silk gloves used by British airmen, woollen gloves and eider-gloves. For our heads we had caps with earflaps like those worn in Tibet, and for the rest, the ordinary Arctic equipment.

The oxygen apparatus

With the Institute of Physiology of Geneva we constructed equipment of the closed circuit type weighing 5 pounds. We used the Chemox canister manufactured in the United States and adapted to it the inhaling apparatus of plexiglass, but without rubber tubes and without mask. The theory of this type of equipment is that the expired carbonic gas combines with the tetraoxide of potassium and liberates the oxygen for inhalation. As I have good reason to think that the 1953 British Everest Expedition was equipped with a very similar kind of apparatus I will not go into full details of this purely technical problem. I consider this system of closed circuit to be the best, with the restriction that the inner resistance of the closed circuit must be corrected, because it was this factor which handicapped us at the greatest heights.

Food

This problem reduces itself to a question of vitamins, and of acid food and glucose in a liquid form. Our own experiences showed that the chemical vitamins are not sufficient to replace completely the living vitamins consumed. That is why on the way back the members of a Himalayan expedition are generally seized with a vitamin hunger. I can tell you from bitter personal experience that on my return from both expeditions I devoured anything I could find in the nature of vegetables or fruits (mushrooms, turnip leaves, wild spinach and so on).

But at great altitudes, where the air is of a dryness similar to that of the desert, the greatest plagues are those of thirst and the wind. Food is possible only in liquid form and we were glad we had brought tinned orange juice. This contains glucose and sufficient living vitamins to feed the body at these altitudes where the mastication of solid foods is unsuitable because of the decrease of saliva and its thick consistency. Moreover, citric acid is an excellent antidote against alkalosis, *i.e.* the alkalinization of the body, a well known phenomenon which takes place at high altitudes.

The disadvantage of tinned juice is its weight, but this is of minor importance in comparison with its utility. It is far better therefore to increase the number of porters, which must be increased in any case, and to avoid the recurrence of the terrible handicap which hampered the two assault parties to such an extent: the Sherpas reduced to impotence by the great height.

APPENDIX II

General organization and team

The Committee created in Geneva had at the same time to choose the team and to organize the scientific mission. The Foundation for Alpine Research in Zurich was negotiating the whole affair, taking steps to arrange the transport of men and material already packed in Zurich.

Concerning the team, we were convinced that the homogeneity of the members of an expedition can greatly improve their output. With this idea we chose

"Organ-pipe" snow structure on Nuptse ridge

members of a Geneva mountaineering club called "Androsace," which is a very good school for climbers and is in reality a nursery for strong alpinists. To avoid the psychological incompatibilities which occur so often in expeditions, the cause of difficulties and of unnecessary loss of energy, we chose men who had been accustomed to climbing together for many years and who had a good knowledge of themselves, of their physical strength, of their character, and of what they could expect from each other. They made up a very strong homogeneous team. René Dittert was the technical leader for high altitudes. He and André Roch, our photographer, were in the Himalaya for the fourth time. Dr. Chevalley and myself were there for the second time. This permitted all members of the expedition, from the Base Camp to the furthest patrols, to be roped in and managed by Himalayan climbers who were experienced and perfectly aware of Himalayan conditions. The other members were: Raymond Lambert, Leon Flory, Ernst Hofstetter, René Aubert and J. J. Asper. The scientific mission was composed of Mrs. Lobsiger-Dellenbach as ethnologist, Professor Augustin Lombard as geologist and Albert Zimmermann as botanist.

As far as it was possible we chose men neither too young nor too old (between 30 and 40) for it is a well-known fact that men of twenty are no more fitted than are men of forty to encounter great heights. Younghusband was one of the first to draw attention to this fact, followed by Hartmann. The pulse question is closely bound up with that of age; I should not like to omit laying stress on this important matter. The observation of the pulse is the best way of testing the acclimatization and adaptation of the climbers. Acclimatization is not the same as adaptation. You get acclimatized to conditions compatible with life (for instance up to 6000 metres, where recuperation is possible): or you can get adapted to conditions incompatible with life for a short while (above 7000 metres) where no recuperation is possible. The pulse suffers modifications accordingly, corresponding to the individual's resistance to height.

We made our first observations on this matter in our 1949 Kanchenjunga expedition. The pulse was taken in complete rest only in the morning on waking. We could observe three type of pulsations, which we called: the indifferent pulse; the sensitive but compensated pulse; the sensitive non-compensated pulse.

The differentiation of these three pulses is only that the indifferent phase varies with the resistance to height of the individual. For instance, Mr. A. has an indifferent pulse up to 5000 metres, at which height, it begins to play about. Mr. B. has an indifferent pulse up to 4000 metres, where the same joke begins for him. But Mr. C. has an indifferent pulse only up to 1500 metres. This is more than a joke, and it is better for him not to go to the Himalaya. Consequently Mr. A. is the more resistant of the three and fittest for the 8000 metres height, which will certainly not be the case for Mr. C. The sudden slowing down of the pulse is the first sign of an effort to get acclimatized. This modification is immediately compensated and the rhythm of the pulse returns to its normal level. But from this moment the pulse is quiet no longer and has an ever more marked tendency to increase its rhythm in an up and down movement.

DISCUSSION

Evening Meeting, 30 March 1953

Before the lecture the PRESIDENT (Mr. J. M. WORDIE) said: Her Late Majesty Queen Mary became a Patron of the Royal Geographical Society in 1932 when she visited the new building with King George V. They marked the occasion

Folded strata in Nuptse ridge

by presenting the Society with two minature globes which are on view in the new Map Room.

Queen Mary took a great interest in the Society's activities and made many visits to the Society. She was particularly interested in mapping. Lord Chetwode once told me that in his younger days he was responsible for taking Queen Mary round during military manoeuvres at Aldershot, when they found themselves adrift. Queen Mary insisted on the map being set correctly, and as Lord Chetwode said, the use of the word "set" told that the Queen knew all about mapping.

Queen Mary made many other gifts to the Society and in latter days presented some atlases, including one which she had used as a schoolgirl. Her last visit was in 1947. I feel sure you will all wish to rise with me in tribute to the memory of our late Queen and Patron.

Then the PRESIDENT continued: Our lecturer this evening is Dr. Wyss-Dunant, a very well-known climber and traveller. My first knowledge of him personally was his ascent in East Greenland of Mount Forel in 1938. That was a great achievement. Also among the great achievements of his country is the expedition which Dr. Wyss-Dunant led to Mount Everest, and we are all looking forward to his lecture.

Dr. Wyss-Dunant then read his paper

The PRESIDENT: We have with us H.E. the Swiss Minister and we should be glad if he would care to say a few words.

H.E. THE SWISS MINISTER (M. de Torrente): Mr. President, Ladies and Gentlemen, it is with pleasure and pride that I have listened to the account which Dr. Wyss-Dunant has given us of the Swiss Everest Expedition of 1952. With "pleasure" because, like any of you, I am intensely interested in mountains and in foreign lands; and with "pride" because these stirring and courageous deeds were accomplished by compatriots of mine. I regard it also as an honour that the representative of one of the smallest countries has been called upon to lecture in this Hall of the Royal Geographical Society whose rooms have been the spiritual home of so many of your Empire-builders. Explorers the world over have had much support and encouragement from your Society. Indeed, for a long time one regarded geographical exploration nearly as a British prerogative.

Your men and your Society have not only set high standards which serve as an example to all who endeavour to follow in your path, but you have also most unselfishly been willing to help others. The Swiss Everest Expedition has been no exception in this respect, and your reception tonight of Dr. Wyss-Dunant and his lecture has proved it once more. I and my compatriots thank you most sincerely for your hospitality.

Sir EDWIN HERBERT (President, Alpine Club): Mr. President, Ladies and Gentlemen, I feel you would like to join me in expressing our gratitude to the lecturer for his lecture and our sense of admiration for the magnificent performance which Dr. Wyss-Dunant's party put up on Everest. There is no doubt—and I mean this literally—that they pushed their effort to the very limit of human endeavour.

They have done three things which are of great value to us. They have proved the solution of two problems; they have defined one problem and they have posed another. The first thing they have proved is that there is a practicable way up Everest from the south. Secondly, they have proved that if oxygen is going to be used at all it must be used continuously and not intermittently, preferably from 21,000 or 23,000 feet upwards.

The problem which they have defined is that Everest will only be climbed by a fit party, assuming that the weather is right, going for the assault from a prepared camp and looked after by other people. It is incredible to think that Lambert and Tensing made that attempt and got so near to the top after having themselves prepared three consecutive camps on three consecutive nights and having slept in the last one—if "slept" is the right term to use—without either sleeping-bags or food of any shape or kind. If a party can be put into such a position as that last camp, the camp having been prepared for them and they having been nursed as far as possible on the way there, then there is a good chance of getting up to the summit of Everest, but it does require that, and the Swiss have, I think, proved it.

The problem that they have posed is a serious one. What I have had to say about the necessity of starting the assault party from a prepared camp up the South Col means that there has to be a tremendous amount of support at and below the South Col, and that means that a great many people, not only Europeans but Sherpas, have got to get through that ice-fall and up the Lhotse wall to the South Col, which is a very serious undertaking indeed. The question is whether that must necessarily be done in any particular spring before the monsoon starts, or whether the possibility is not better after the monsoon and before the heavy winds are re-established. I think that the lecturer would agree that in their effort to avoid going up the centre of the ice-fall they went very dangerously near to the western buttress or western ridge of Everest. I believe that after the monsoon later on they found it was possible to go up the centre of the ice-fall; difficult, but probably safer. It may also be that the Lhotse wall from the West Cwm up to the South Col is more practicable after the monsoon with more snow than it is before. That is another problem they posed. On the other hand, if a party get to the South Col after the monsoon they may find that the wind—as the Swiss found it in their post-monsoon effort—will make it quite impossible to go any further.

I think the Swiss Everest Expedition has added greatly to our knowledge of the topography of the mountain, the way of approach, the means of organizing the expedition and of the physiology concerned. I am sure we are all very grateful to them and I close by saying this personally: I hope that having done so much before, the British will get up Everest, but if it is not to be the British—let it be the Swiss.

THE EAST COAST FLOODS

JANUARY 31 – FEBRUARY 1 1953

J. A. STEERS

THE FLOODING which took place at so many places on the east coast between the Tees and Dover on the night of 31 January 1953 was serious both to life as well as to property, whether houses or land (Fig. 1). It is estimated that 206,161 acres [1] were definitely flooded (and possibly another 11,732), and that 307 people lost their lives. It is impossible to minimize this disaster, but nevertheless it is right to realize that the results might have been far more serious. We are more than fortunate in that the rivers, particularly those flowing through the fenlands were not in flood; we were fortunate too in that the surge did not occur at the top of the tide and, what is of still greater significance, did not occur on a high spring tide.[2] The predicted tides for January 31 were 1–3 feet less—according to locality—than can occur at other times of the year. There is little doubt that if the surge had occurred under conditions of a high spring tide and flooded rivers, the whole of the Fens, and other similar places, would have been submerged, mainly by fresh water.

Surges are not uncommon, but it is only of comparatively recent years that they have been investigated. It is a matter of great regret that Dr. R. H. Corkan, who had studied the subject more fully than anyone else in this country, died a young man, only a few years ago. The account he gave of the surge on 8 January 1949, and of the conditions under which it was generated, are applicable in a remarkable way to the surge of 31 January 1953. On the other hand, the violence in 1953 of the storm in the northern part of the North Sea was exceptional. The devastation of the forests in north-eastern Scotland moreover and the abnormally high northerly winds in the Shetland–Orkney area meant that, despite the far less disastrous wind action in the southern part of the North Sea, there was very rough water—far more so than is usually associated with such north-westerly, or north-north-westerly winds, as prevailed.

In this paper no account is given of the profound damage that occurred in Holland. The surge which travelled southwards along our east coast later turned and moved northwards along the coast of the Low Countries, where it was accompanied by an on-shore wind in which occasional gusts exceeded 90 miles per hour.[3] It needs but little imagination to understand what

[1] I am particularly indebted to Dr. E. C. Willatts and his colleagues in the Ministry of Housing and Local Government who gave great help not only with the maps but also with the photographs The figures are from measurements made in Dr. Willatts' office.

[2] "The peak of a surge of short duration may occur at any state of the tide." K. F. Bowden, *Weather*, March, 1953, 82.

[3] "The on-shore direction of the winds on the coast of Holland averaged 50 to 60 knots for 6 to 9 hours before high water." H. A. Q. v. Ufford, *Weather*, April 1953, 116.

Fig. 1. Flooded areas on east coast, 1953

happened under such circumstances to a country almost entirely protected by dykes or dunes.[1]

The meteorological conditions

It is interesting to consider the sequence of events from noon on Thursday, January 29, until noon on Sunday, February 1. Fig. 2 shows the position of the centre of the depression for every six hours during that time. It will be noted that the pressure at the centre of the depression fell from 1004 millibars at noon on January 29, to less than 968 mb. at 6 a.m. and noon on January 31. During this period the winds strengthened, so that the forecast issued at noon on Saturday, January 31, said, "All districts will have gale-force winds, severe in many places, and squally showers, mainly of hail or snow. Considerable snowfall may occur over high ground. Thunderstorms will occur here and there. It will be cold." [2]

The general track of the depression from the Atlantic, around the north of Scotland into the North Sea, and the accompanying movement of the anti-cyclone behind it meant that a very powerful northerly air stream swept down the eastern side of Britain and the western part of the North Sea. The records of the Daily Weather Reports taken individually do not perhaps suggest excessive wind speeds: at midnight, January 31 (*i.e.* Friday–Saturday night) 50 knots were recorded for Benbecula and Stornoway; at 6 a.m. on Saturday Benbecula recorded 53 knots, and over the north of Scotland wind speeds between 35 and 45 knots were common. Farther south, along the east coast, London Airport recorded 22, Felixstowe 28, Gorleston 18, Spurn Head 25, Tynemouth 24 and Leuchars 26. At midnight, Saturday–Sunday, the wind speed at London Airport was given as 13 knots, 34 knots at Gorleston and 16 at Leuchars. These speeds however are somewhat misleading if taken by themselves. The great damage to forests in north-eastern Scotland in itself implies something quite exceptional. The wind record at Aberdeen University station (to some extent sheltered) shows gusts up to 75 knots, and from about 9 a.m. to 9 p.m. January 31, the velocities were high—many gusts throughout the whole day exceeding or reaching 50 knots. Velocities of hurricane force are recorded on the chart for mid-day of January 31. The wind velocities shown in Fig. 3 give a better impression of the severity and length of the storm.[3]

Along the east Scottish coast, and probably as far south as Flamborough Head, the winds were abnormally strong although they abated somewhat farther south on our coasts. The Low Countries on the other hand suffered almost the full force of the storm.

What is of great significance in relation to sea conditions is the sequence of winds in the North Sea basin. At 6 a.m. on Thursday, January 29, the winds in the North Sea were from a little north of west on the English side, becoming more westerly on the Dutch side. Much the same conditions prevailed

[1] I was able to visit most of the flooded areas very soon after the disaster, thanks to the Nature Conservancy who allowed me to extend a research grant for the purpose.

[2] In this section I have made great use of the Daily Weather Reports of the Meteorological Office.

[3] "On Costa Hill, Orkney, several gusts exceeded 105 knots (121 m.p.h.); the highest reached 109 knots" (M.W. Report, January 1953).

throughout Friday except that there was rather more south in the winds in the Flemish Bight. At 6 p.m. on Friday the winds over nearly all the North Sea were approximately south-west and by midnight this was accentuated, so that at Felixstowe the velocity was 18 knots from a direction 20° west of south and at Gorleston 23 knots from 10° west of south. On the coast of Belgium and Holland there were fresh to strong breezes from south-west to south-south-west.

As the depression advanced into the North Sea it became more intense, and the maximum gradient behind the centre held from midnight to 6 a.m. on February 1. Thus both maximum depth and gradient occurred when the depression was in the North Sea. At noon on Saturday winds of hurricane force are indicated on the chart between Orkney and Moray. These were blowing from almost due north. All along the east coast of Scotland velocities of 50 or more knots are recorded, the direction being in general about north-west. At 6 p.m. there was still a fresh gale, the winds being on shore on the south side of the Moray Firth and at Hunstanton, but otherwise obliquely offshore from north-north-west except for parts of north Norfolk. It was the worst northerly gale on record in the British Isles.

Tidal conditions

Full moon was at 11.44 p.m. at Cambridge on Thursday, January 29. At Hull and Leith the maximum predicted tide of that particular set of springs fell in the afternoon of Sunday, February 1. At London Bridge the maximum was predicted for the morning tide of Sunday. None of these maxima however was noticeably a high one.[1] At London Bridge the predicted tide may be rather more than 2 feet higher than that on January 31, that at Hull may be 3 feet higher and at Leith rather more than 2 feet. Thus, as far as ordinary tidal maxima were concerned, there was no reason to expect anything unusual.

Where however the actual tides are examined, it will be apparent that there was a great discrepancy between them and the predicted tides. The curves in Fig. 4 show that at Aberdeen the day-time tide on January 31 was nearly 3 feet, that at Immingham 7 feet, that at Southend nearly 8 feet and that at Dover approximately 6 feet higher than predicted. Where records are available it will also be noticed that the height of the next succeeding tide was rather higher than anticipated.[2]

The third line on Fig. 4 is obtained by taking the difference between the predicted and actual curves—and it is thus the measure of the surge. The maximum of the surge was usually about three hours later than the maximum of the tide. The amplitude of the surge amounted to about 2 feet at Aberdeen, 7 feet at the mouth of the Tees, 7½ at Immingham, about 9 at Southend, and about 7 at Dover.

The surge swept along the east coast of Britain from north to south and sent off branches into inlets like the Wash and the Thames Estuary. It may in some ways be compared to a tidal bore. The 'Admiralty Manual of Tides' (1941) defines a surge as "a water movement which is quickly generated and

[1] The eclipse on the Thursday–Friday night had no appreciable effect.

[2] I am much indebted to the Hydrographer to the Navy, to Commander Farquharson R.N., and to my colleague Mr. W. W. Williams, for information in this section, and also for the curves in Fig. 4.

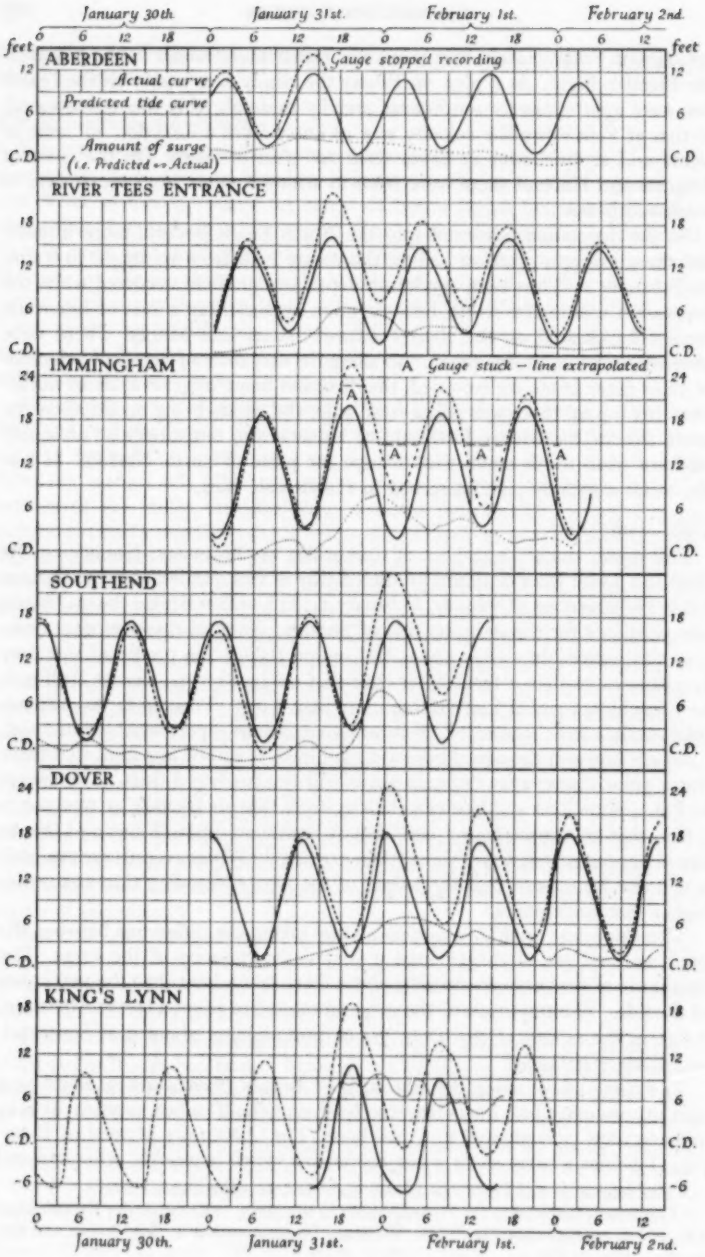

January 30th.
January 31st.
February 1st.
February 2nd.
feet
ABERDEEN
Gauge stopped recording
Actual curve
Predicted tide curve
Amount of surge
(i.e. Predicted ~ Actual)
C.D.
RIVER TEES ENTRANCE
IMMINGHAM
A Gauge stuck — line extrapolated
SOUTHEND
DOVER
KING'S LYNN

Figure 4

whose effects are soon over" and then continues as follows: "The rapidity of generation, the notable rise (or fall) of the sea level, and the manner in which the surge travels, are characteristics which distinguish it from other meteorological disturbances of sea level. Clearly the mechanism of generation and propagation is not unlike that of the bore. . . ."

Because of the small size of the North Sea the local tides result from oscillations travelling in from the Atlantic round the north of Scotland. Because of the shape, size and depth of the North Sea three nodal lines occur (see Fig. 5). Between any two lines, high (or low) water will occur simultaneously, and the maximum range will be half-way between any pair of lines, and in crossing any line one passes from an area of high (or low) water to one of low (or high) water. If now the effects of gyration are added, forces are brought into being which deflect the tidal currents to the right and so at certain hours gradients occur along the nodal lines. In other words, there will be oscillations along the nodal lines, but at some point on any given line the water level will remain constant. This is the amphidromic point, around which the tidal oscillations turn in an anti-clockwise direction and produce the conditions shown in Fig. 5. One effect of friction is a loss of energy which in turn has a diminishing effect on the range of the tides and also produces a difference between the eastern and western shores. This is most markedly the case in the northern part of the North Sea.

Fig. 6 makes it clear that the high (or low) waters become progressively later from north to south along the east coast of Britain. The surge followed this direction, and it is clear that a warning system can, in principle, be quite effective since the surge arrives considerably later off, say, East Anglia, than it does off Dunbar and because the height of the surge may also increase in the same direction. At King's Lynn, for example, the predicted tide was 22·9 feet above the dock sill; the actual tide reached 31 feet—the surge, in other words, was 8·1 feet high. This, in the opinion of Mr. Doran, Chief Engineer of the Great Ouse River Board, was the greatest that had been experienced at Lynn for many years, possibly for centuries.

In considering the tidal and surge phenomena which accompanied this storm, it is interesting to refer to the North Sea levels during the storm of 8 January 1949. The meteorological conditions on that occasion and on 31 January 1953 had many points in common—so much so that it is relevant to quote from Corkan's paper [1]: "The origin of the disturbance as indicated by the weather maps was a deep depression which developed very rapidly off the north-west coast of Scotland and then passed quickly eastwards across the extreme north of the North Sea and Southern Norway. The passage of the centre of the depression across the North Sea was accompanied by a rapid veering of the winds in the rear of the depression, from south-west to north-west and north, and it is of some importance that for a short time strong northerly winds were localized in the western half of the North Sea and were particularly affecting the east coast of the British Isles. These conditions were very soon followed by nearly uniform conditions of a northerly type over the whole North Sea which lasted until the disturbance subsided."

[1] *Phil. Trans. Roy. Soc.*, 242, 493, 1950. See also *Assoc. Oceanogr. Phys., Procès-Verbaux* No. 5, 167, 1952; *Dock and Harbour Authority*, 28, 3, 1948.

In this case also the surge travelled down the east coast, and at King's Lynn it reached 5·5 feet high, which was its maximum. This disturbance took 10 hours to travel from Dunbar to Southend, and Corkan found that the speed of transmission of a surge and that of the diurnal tide along our coast are almost identical. The tidal conditions were not however quite comparable to those on January 31 of this year, since on the 7 January 1949, the day before the surge, the moon was in its first quarter, and so neap tides prevailed.

The effects of the flooding on the coastal areas

Some damage occurred in Northumberland, Durham, and on the coasts of north-east Yorkshire, but in Holderness, near Easington, the sea broke over the dunes and the flood water made exits to the Humber near Skeffling. Spurn Head does not appear to have suffered much change.

The Lincolnshire coast is nearly all low and flat. There is a small cliff at Cleethorpes, now protected by the promenade. From there right round to the Wash no solid ground reaches the sea. Nearly all the area—known as Lincoln Marsh—is reclaimed ground protected by walls and dunes. Between Cleethorpes and Donna Nook there was some flooding, and breaches were made in walls. The airfield at Northcoates Point was submerged. Southwards from Donna Nook, even as far as the northern end of Mablethorpe, the amount of damage was relatively small. Where the dune belt and the beach are both wide the sea did little harm. Part of the energy of the waves was expended before they reached the dunes. These were certainly cut away, often deeply, but they made a real barrier. The most striking effect of dune protection was to be seen at Mablethorpe. About a mile north of the Coastguard Station the dunes held, even though they are much narrower than at Theddlethorpe. But in Mablethorpe itself there were serious flooding and damage. This was continuous with the damage at Trusthorpe and Sutton—and represented the most impressive on the whole of the east coast. Between Mablethorpe and Sutton the dunes were narrow, for the most part protected by sea walls. The sea level rose higher than the pull-overs to the beach and flooded the land within. The narrow beach allowed access of bigger waves, and the abnormal height of the water washed away dunes and walls and invaded the towns. The damage in this area was considerable, and once the dunes or wall had disappeared the sea in some places could directly attack the houses. This was so at the southern end of Sutton where the Beach Hotel suffered. It must be remembered, too, that in Mablethorpe and Sutton, and to a lesser extent in Trusthorpe, the main coast road runs immediately inside the dunes or wall and is particularly vulnerable.

South of Sutton the "Roman" Bank acted as a very sound inner bank and was not breached. At Anderby the dunes are somewhat wider, and although seriously eroded, the line remained fairly intact. Several houses on the dunes were partially undermined. Much the same occurred at Chapel Point, where the sea swept over the wall. The dunes to the north, although not very wide, stood up well. Serious breaches were made at Ingoldmells, and there was a good deal of flooding—including the large Butlin's Camp—south of the point. With the widening of the beach towards Skegness the damage decreased, and no marked alteration took place at that town or at Gibraltar Point.

Miss King and Mr. Barnes, both lecturers in geography at the University of Nottingham, had studied Gibraltar Point in some detail, and after the flood examined not only it, but also took profiles through the beach and dunes along nearly all the Lincolnshire coast.[1] Their sections are shown in Fig. 7 and illustrate remarkably clearly the effects of steeper and narrower foreshores in leading to greater destruction of dunes and sea walls. One effect of the storm was to scour away the beach and leave extensive areas of mud, and in some places of peat, exposed. Much of this beach material was thrown inland.

Apart from occasional flooding, due to high levels, little happened in most parts of the Wash. The surge at King's Lynn was estimated at about 8·1 feet. Most fortunately the Fen rivers were not in flood. All the sea banks in the territory of the Great Ouse River Board have been raised and strengthened in the last half century. The reason for the breach in the Ouse walls at Wiggenhall was primarily the unusual height of the surge, which overtopped the wall. The river is tidal up to Brownshill Staunch. The high water level at Lynn was 18–21 inches above the level of the sea at Hunstanton, and the level at Denver was somewhat below that at Lynn. It was too much for some of the banks. The cause of the bank failures was erosion of the *back* of the bank, except possibly in one case where it may have been due to a rat hole.[2]

On the east side of the Wash at Heacham and Hunstanton there was much damage and loss of life. The bungalows and other light buildings faced west, and even the narrow width of the Wash seems to have had some effect, since the wind and waves were directly on shore. Moreover, behind most of the bungalows the ground level falls for a short distance, so that it was impossible for people to make quickly for higher ground. The damage to the promenade at Hunstanton was noteworthy, especially in view of its relatively sheltered position. The cliffs were also cut away here and there.

Along the coast of north Norfolk, from Old Hunstanton to Weybourne, the most obvious effect of the storm was the flooding of all the reclaimed marshes. The sea walls were overtopped, and breaches formed in most cases from the rear. The great bank running from Wells Quay to the harbour mouth was partly breached in this way, and walls and outhouses facing the marshes were knocked down by the waves inside this wall. The water ran up the old Warham Slade and for a time was 3 or 4 feet deep across the main road at the head of the Slade. The water from the entrance to the Slade also swept into the town and for a time submerged the Station.

On the other hand, natural salt marshes suffered not at all. Dunes were often eroded, but they too often stood remarkably well. On Scolt Head Island the seaward foot of the high dunes near the Hut was cut back 8–10 yards, and changes of that order, or even more, occurred in lines of dunes facing west or north-west. Low dunes were overrun and often washed away. Shingle spits were driven in, but apart from the washing away of the low dunes which face much of the foreshore of the island, the waves did little else than overrun the beach, somewhat flatten it and wash shingle and sand on to the marshes. Only in one place, already partially breached, does it seem likely that a

[1] In *Survey*, Nottingham University, 3, 29, 1953 (March).

[2] Information in letter from Mr. Doran (the italics are mine, J.A.S.).

long-lived gap will endure. Blakeney Point suffered more, partly because along much of it there is deeper water. The Headland and Far Point, in many ways like the corresponding features at Scolt Head Island, were cut into and partly washed away. The main shingle beach was overswept and pushed inland throughout its length. Opposite Salthouse a definite breach was made. This village suffered greatly, and not for the first time in its long history. Since there is high ground immediately behind, refuge was easy. At Cley and Wiveton flooding was severe, and conditions in the Glaven Valley must have resembled those in the great flood of 1897.

Along the cliffed coast of Norfolk there was some loss, particularly where the cliffs are low as at Bacton and Walcott. The main street of Walcott was destroyed, and many buildings wrecked. At Sheringham the cliffs behind the promenade were severely attacked; Cromer, too, suffered somewhat in this way. Erosion has long been serious hereabouts, and throughout their length the cliffs offer very little resistance. Moreover, the beach tends to steepen, especially beyond Happisburgh. A few miles farther east the cliffs cease and give place to a dune coast. The dunes have been "trained" and blowouts mended, the summit of the sandhills is kept fairly level, and marram grass planted. Nevertheless this is a very vulnerable part of the coast, and in 1938 there was a serious break at Horsey which led to the flooding of 7,469 acres. In January 1953, the only break occurred at Palling, but the dunes have been seriously pared away, and it is more than fortunate that storm and surge conditions were relatively shortlived, otherwise severe flooding in Broadland would have taken place.[1] The wall built across the 1938 gap at Horsey helped greatly in maintaining this stretch. At Winterton the dunes widen again, but have suffered loss all along their front. Here too the beach is fairly steep.

In general, eastwards of Cromer the winds were more and more offshore, and beyond Winterton Ness and as far as the Thames Estuary this was especially noticeable. In terms of direct erosion the sea did comparatively little damage except locally. At Kessingland, for example, at the northern and unfinished end of the new sea wall the cliffs were attacked at an unusually high level and were cut back. The same is true of the soft cliffs at Covehithe. At Dunwich the cliffs, equally soft, scarcely suffered at all at their northern end. On the other hand, flooding was often serious, and large areas of Lowestoft were covered with water which came in both behind and over the sea walls which themselves stood rigid. Even as far inland as Haddiscoe the water coming in through Lowestoft, and to some extent through Yarmouth, caused no little damage to a railway embankment. All the valleys, many of them blocked by shingle bars, along the Suffolk coast were flooded. At the south ends of Southwold and Aldeburgh the low lying ground was inundated and damage done to property. The bungalows that suffered at Southwold were situated behind a seawall on and in front of which small dunes had formed, and were in much the same position as were the houses at Mablethorpe and Sutton. But the barrier between them and the sea was much weaker.

The Alde did not break through at Slaughden. The walls on its north bank broke, and the shingle bank between Aldeburgh and Slaughden was flattened.

[1] The width of the dune belt near Waxham is about half what it was.

The breach at Palling, Norfolk. Compare damage to dunes on right of gap (east) with photograph of Waxham, facing p. 297

For a time there was an overflowing of the sea at high water, but the river maintained its course. Even if matters had been left to nature I think this would have been so, but the flattened shingle was bull-dozed up from the inside, and a new, even if thinner, ridge was soon made. However, the original ridge all the way from Aldeburgh to and beyond the Martello Tower was displaced perhaps 50 yards landwards.

Apart from flooding, which occurred all along the coast, the breaking of some dykes and local erosion of cliffs, there was nothing of major importance until, just to the south of Clacton, the bungalow town of Jaywick was severely hit. The sea once again overtopped the wall at the south end of the settlement and soon made a breach. The water also came in from behind. The whole place is below high water mark, and flooding to a depth of 5 feet or so occurred over much of it. The caravans, as at Ingoldmells and other places in Lincolnshire, were swept far from their original sites and usually much broken. Even some permanent bungalows floated away and overturned. But the masonry sea wall along the main front was undamaged (Fig. 8).

The same kind of calamity affected Canvey Island. The major walls along the Thames held, and the flooding took place mainly over the lower and weaker walls along Benfleet and other creeks. Here, too, once the walls were overtopped, these were eroded from the inside. Canvey has far more permanent inhabitants than Jaywick, and so material damage and loss of life were very serious. In both cases the settlements are below high water mark. At Foulness Island the walls at the north and north east were breached, and another big gap was made opposite Wakering. The whole island, together with its smaller neighbours, was inundated, and much valuable arable land spoiled (Fig. 9).

On the south side of the Thames Estuary the winds were more directly on shore. There was considerable erosion in Sheppey and also in the soft cliffs at Beltinge just east of Herne Bay. The ruined church of St. Mary at Reculver had been protected, but there was some erosion there. The low ground west of Whitstable was flooded, and huts and houses at Tankerton damaged. The low ground between Reculver and Birchington was flooded, and the main north Kent railway put out of action. Beyond the North Foreland there was far less damage, and although flooding occurred, the effects of the storm were of minor significance.

In the Thames and other rivers as far north as the Tees, inundations due to overtopping of walls and the formation of breaches took place. There is no need to enumerate all these. The same series of events occurred in each place, and Fig. 1 shows far better than a long description how much of the coastal district was flooded.

Effect on industry

The damage to industry is perhaps not so fully realized as is that to domestic housing. The flooding in rivers and estuaries was extremely serious in this respect, and damage including that to the West Norfolk Farmers Manure Co. at King's Lynn and to Birds Eye Foods Ltd. and other firms at Yarmouth was great. In the Orwell estuary there was also severe flooding; twenty-two firms, as well as a Gas Works and a Power Station, were seriously affected.

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Canvey Island, after the storm: main Thames wall on right

Much the same happened in the River Colne, and some works here and elsewhere had to cease production entirely for periods of one to four weeks. The same conditions, often intensified, occurred in the Thames, and factories at Purfleet and other places, including those of Messrs. Van den Bergh and Jurgens, and the Thames Board Mills Ltd., are examples of many that suffered seriously.

In estimating the effects of the storm, full allowance must be made for the loss suffered by industry both as a direct result of the flooding and also because of the fall in production as a consequence of it. Many industrial plants are situated on low ground and so preserve land which is often better used for other purposes. Moreover, proximity to navigable water is essential, and adequate protection of works and factories in these situations is of vital importance to the country as a whole.

Transport was locally much disorganized. Two hundred and twenty miles of track and eighty stations were temporarily out of service. Many hundreds of railway carriages were flooded. Several premises of London Transport, British Road Services, and the Tilling Group were also flooded. Docks at King's Lynn, the Humber ports, and the Hartlepools suffered, as also did stocks in the warehouses.[1]

The effects on agricultural land

Land flooded by salt water presents several problems. Flooding, whether by salt or fresh water, temporarily destroys the tilth and makes the soil pasty and largely impervious to air. Salt has the further disadvantage of causing damage to crops, the extent of which will vary with the salt tolerance of the crop—barley, for example, can tolerate up to 0·25 per cent. and some grass up to as much as 0·3 or 0·5 per cent. Evaporation in summer may raise the salt content to lethal proportions.

But the more serious long-term damage arises as a result of the substitution of calcium by sodium in the clay fraction of soils. This is a factor which is of the greatest significance in heavy soils, which may become very sticky and dry into hard lumps which will not crumble when subjected to frost or wetting.

It is essential to get rid of the flood water as soon as possible by whatever form of draining is most appropriate. Sometimes flooding with fresh water may be proper, and the water should be applied as fast as the soil can absorb it. This process is unlikely to meet with much success on heavy land.

There is no simple method of estimating how long land will be out of production, because there are too many variable factors such as the permeability of the soil, the efficiency of the drainage system, the local *winter* rainfall and the amount of salt in the soil and its distribution therein. No field flooded by ordinary sea water this winter is at all likely to bear a crop this year, but if the water is only somewhat brackish, a summer crop is not an impossibility, especially if other factors are favourable. Many cases are known where land flooded by sea water carried quite good crops after one whole winter's rain. On the other hand, heavy and poorly drained soils may

[1] *British Transport Review* 11 (1953) 338, and *The Railway Magazine*, May (1953) 301.

need five or more years before they can bear crops. Past experience in the coastal parts of Lindsey shows that strong clay land is best left quite untouched for a year and, when work starts, as little weight as possible should be used. Cultivation should be light and begin from the surface. But on the light and well-drained silt lands on which the flooding was of short duration, it may be possible to grow crops this year in Lindsey—and there is little doubt that barley is the most successful crop following flooding by salt water. But it is important to bear in mind that just because a first crop is successful the land has not necessarily recovered. In Holland a second crop has often failed largely because damage to soil structure does not reach the maximum until after the bulk of the salt has been washed out. On some land gypsum treatment may be effective. The gypsum is spread on the surface and is gradually dissolved and washed into the soil. In an average winter little more than a ton of gypsum per acre is likely to be dissolved, but 2–2½ tons per acre should be spread in the dry weather of summer or autumn this year.[1]

These few remarks are sufficient to emphasize that the problem of recovering land from flood water is complicated. Quite a different group of problems arises in considering the feeding of livestock on flooded areas. There is no space to develop this subject, and it must suffice to note that some forage crops may be killed, but that some salt-tolerant grasses may survive. Moreover the salty deposits left in the land may be toxic to animals, and some food crops may absorb salt. After effects, such as moulds forming on flooded hay, may all too easily develop. Furthermore the salt content of drinking water used for animals may easily become too high and bring further trouble.[2]

The subsidence of eastern England

A subject which has given rise to considerable interest is the downward movement which is known to be taking place in south-eastern England. There is little need for me to deal with this matter in detail, since Dr. Valentin, who has been working in the Department of Geography at Cambridge, discusses it at some length in the paper immediately following this. It is however important to emphasize that the movement at the present time can be measured with reasonable accuracy from tide gauge observations. In the region of the Thames approaches it is of the order of 1–2 millimetres a year, which is equivalent to a foot in 150–300 years. This is a significant amount, and throughout a long period of time has made itself felt in various ways. The Thames is now tidal to Teddington; in Roman times it was probably unaffected by tidal influences above London Bridge. The change of level since Roman times may amount to 15 feet, but the subsidence dates back much earlier, and the alternate silt and peat bands that have been so often demonstrated in dock sections imply a sinking which possibly occurred in stages from

[1] The physical properties of clays depend on their chemical composition. In particular, the replacement of calcium, present in normal clays, by sodium from the salt left by flooding with sea water causes the clay to assume intractable properties. The addition of gypsum (calcium sulphate) provides once again an excess of calcium which restores the clay to its original chemical composition and physical properties.

[2] See particularly: Min. of Agriculture and Fisheries Advisory Leaflet on "Treatment of land flooded by sea water," March 1953, and Supplement to the Lindsey A.E.C. "Cropping and treatment of land which has been flooded by salt water," 1953.

the time when the North Sea floor was exposed. The earlier stages are the concluding episodes of a long and tangled story dating back to Pliocene times; but the superposition of Roman on Iron and Bronze Age sites at Brentwood gives us a good measure of the prehistoric and historic part of this movement which is still in progress. That the movement may be partly isostatic—the result of subsurface changes resulting from the relief of the weight of the great ice sheets of Pleistocene times—and partly eustatic, in the sense that it is associated with the melting back of the Arctic glaciers today, is discussed in Dr. Valentin's account which also gives references to relevant papers.

Future problems

Any long-term planning must, of course, take these isostatic and eustatic movements into consideration. The great flood of last January would have occurred even if this movement had ceased a century ago, but we must realize that two or three centuries ahead the general level of our east coast may well be a foot or more lower than now. This in its turn implies not merely a raising of the level of walls, but also strengthening them so that at their increased height they are still able to hold out the sea. The lessons of the flood also emphasize everywhere that the landward side of the banks needs protection. This is a serious matter, and one that requires much money if it is put into effect. Everywhere on January 31 we heard of the sea overtopping the walls and then scouring out behind them, and in this way producing most of the sea breaches. It may well be that in very vulnerable areas the walls should be duplicated, not so much to prevent entirely an overspill from a very high surge, but in order to have a second line of defence if the outer wall is breached. Whilst it is true that much damage would have been done if the walls had not been breached, it is undoubtedly the case that far more serious flooding resulted from the breaches through which the water rushed.

A study of natural coasts like Scolt Head Island and Blakeney Point demonstrates several points. First, that where beaches and dunes are wide damage may be small. Next, that where the beach is steep big waves break directly on it and override it and, as opposite Salthouse, may form breaches. Where, too, there is a wide area of sand and salt marsh fronting the coast, little trouble occurred, since the sea spent some of its force well away from the coast. Nevertheless, the unusual height of the surge meant that cliffs and slopes were attacked in unexpected places. The low cliffs near Bacton and Walcott illustrate this point very well. At Winterton, another natural district, the much steeper (*i.e.* as compared with, say, Scolt Head Island) beach led to a more severe attack on the dunes behind.

All this means that every effort should be made, when it is at all possible, to help the natural accumulation of beach, dunes, shingle ridges, and salt marsh. The narrow dunes between Happisburgh and Winterton stood up, but they have been sadly weakened. Another storm like that of last January would bring devastation to this stretch of coast and hinterland. It is not easy to alter the beach profiles in this part of Norfolk, nor is there any obvious means of bringing about faster dune growth. The sea wall now being built between Eccles, Horsey, and Winterton is the first necessity.

A very similar, but even more urgent problem, faces Lincolnshire. At Sutton

and other places the dunes and walls disappeared almost *in toto*. A remarkably good job of new walling and defence has already been done. But if Sutton, Trusthorpe, and Mablethorpe are to remain where they are they will need every protection that man and nature can devise. Doubtless the beach will gather again, but can dune growth be engendered? Theddlethorpe and south of Skegness are well protected in this way, because the beach is wider and blowing sand can easily build the dunes. A further trouble in Lincolnshire is the paucity, or even absence, of shingle. There is little or nothing to form a ridge on which dunes might grow. For many years it seems more than probable that the safety of this exposed part of the Lincolnshire coast must depend wholly on man.

Since often the best natural protection is that of a wide beach on which the waves can expend their energy, it follows that it is essential to take an overall picture of the coast. It should be too well known to need emphasis that if the occupiers of a piece of foreshore build groynes to catch the sand and shingle, their neighbours may possibly suffer. Great Yarmouth has undoubtedly gained at the expense of the coast between Gorleston and Lowestoft; Pakefield has lost as a result of Lowestoft harbour works; Southwold harbour holds up material on its north side. These are but examples; many others could be found on our east and south coasts. There may be very good reasons why a particular place should cause beach to accumulate, but are there equally good reasons why, if it so does, another place should suffer? That is the question that has never been satisfactorily answered, and the answer can only be attempted by a central authority trying to see the coast as a unit. Obviously all sorts of problems arise, economic, administrative and others, and to say that what Yarmouth gains is another place's loss is not in itself very helpful since it is difficult to assume that a thriving town could be made to make fundamental alterations in its harbour and promenades.

The loss of life and property at places like Canvey, Jaywick and the central parts of the Lincolnshire coasts is to be regretted in every way in so far as the immediate sufferers are concerned. It is however right to say that the nation acting through its central and local government authorities is in a sense responsible, because if houses and towns are built close behind sea walls and at levels which mean that they could be flooded at any high, or even ordinary, spring tide, those houses are in a potentially dangerous position. Conditions like those existing on January 31 are fortunately rare, but they can and doubtless will recur. They have also occurred in the past. The reasons why the storm of last January will be long remembered are because of the great loss of life and property resulting almost entirely from recent bungalow development and because of its having been so carefully recorded by photography from the air and so fully discussed in the Press. The storm of 1897 and those of earlier times were just as severe, but the number of houses that then existed on reclaimed salt marshes or tidal flats was negligible. Even if this flood had occurred in 1939 the recovery would have been far slower and less effective than it is today. The bulldozer and other war-time and American machines have made a vast difference. Until however all houses are out of reach of tidal water they are in potential danger from flooding, although floods of sufficient magnitude may only take place at long intervals of time.

At all places constant care is required to see that sea walls and banks are kept in good condition. Rat holes, drying cracks, and untended weaknesses of any sort may lead to disaster. On an open beach where there are dunes every effort should be made to foster their growth. The making of paths through them may, in vulnerable places, lead directly to incursions of sea water. This kind of danger is especially troublesome in places where dune growth is small and where holiday makers are plentiful. It is difficult to convince people who only visit the coast for a summer holiday that the making of tracks through dunes may be a very real danger.[1] At other places if a thick growth of vegetation can be encouraged on marshes in front of walls it may have a beneficial effect. That this is so is evident in parts of Essex. It may not be without significance that some of the major breaks at the northern end of Foulness occurred where the width of marsh in front of the wall was small. Although a good deal is known about the ecology of dunes, shingle, and marshes, much more long-term experimental work is required. This can be done at places on the north Norfolk coast where experiments can be allowed to continue unmolested for years if necessary. Nor need these experiments in any way spoil the natural beauty of places like Scolt Head Island and Blakeney Point.

Conclusion

The amount of defence work already accomplished since the flooding is impressive and illustrates most effectively what can be done when necessity arises. It was imperative to protect as far as possible existing settlements since whatever future policies may be adopted it is obvious that, for example, the whole population of Canvey cannot be rehoused in a day! Moreover destruction of dunes and walls has led to the flooding of great areas of good agricultural land, and in the present state of national economy we must win back that land as soon as possible. The restoration of the *status quo* however, even if it can be accomplished, is not the only or even the most desirable end. Long-term planning must take much more into consideration:—the known subsidence of south-eastern England, the travel of beach material and the effects of groynes and harbour-works over long stretches of coast, the growth of dunes and how that growth can be aided or stimulated by human action, the more extensive experimental planting of areas of salt marsh and, still more, of bare sand, as well as the building of protective walls and other defences. It is partly with problems of this type in mind that the Government has appointed a Committee[2] under the Chairmanship of Viscount Waverley. It will be appropriate to end this paper with a statement of the terms of reference of that Committee:

> "i. To examine the causes of the recent floods and the possibilities of a recurrence in Great Britain;

[1] "Trampled dunes may well have helped the attack of the sea on parts of the Lincolnshire coast." D. N. Robinson, *Survey*, Nottingham University, 3, 37, 1953 (March).

[2] Dr. G. M. B. Dobson, Sir Donald Fergusson, Mr. R. D. Gwyther, Sir Claude Inglis, Mr. R. G. Leach, Major Sir Basil Neven Spence, Professor J. Proudman, Mr. A. S. Quartermaine, Lord de Ramsey, Professor J. A. Steers, Sir Miles Thomas, Sir John Wrigley, Mr. T. Yates.

ii. To consider what margin of safety for sea defences would be reasonable and practicable having regard on the one hand to the estimated risks involved and on the other to the cost of the protective measures;
iii. To consider whether any further measures should be taken by a system of warning or otherwise to lessen the risk of loss of life and serious damage to property.
iv. To review the lessons to be learned from the disaster and the administrative and financial responsibilities of the various bodies concerned in providing and maintaining the sea defences and replacing them in the event of damage;
and to make recommendations."

These terms imply a comprehensive review of the disaster and the lessons to be learned from it. Whilst there is every reason to hope that a storm like that of last January will not recur for many years, there is always the possibility that meteorological and tidal conditions may combine to produce a similar crisis any winter. The careful sifting of evidence placed before the Committee, and the appraisal of the points of view of those best able to give advice take some time. The Government and the country should, however, have a report which will set out clearly the dangers that threaten and the best ways of confronting them.

DISCUSSION

Evening Meeting, 11 May 1953

Before the paper the PRESIDENT (Mr. J. M. Wordie) said: Tonight we are very fortunate in having Professor Steers to speak to us about the East Anglian floods. He has for long been an expert on coastal features and coast erosion, and though he was not on the coast when the floods began he lost no time in going there. I hope he will give us a very general picture of how the floods came about and of the effects which they had.

Professor Steers then read his paper

The PRESIDENT: We have here tonight Lord Waverley, who is chairman of the Parliamentary Committee which is inquiring into the floods. I wonder if he would like to say a few words.

Lord WAVERLEY: It is quite true that a few weeks ago I was asked to become the chairman of a Committee on the floods, of which Professor Steers, to whom we have all listened with such interest, is a member. I think I am quite well qualified to be chairman of that Committee and I will tell you why.

Not very long ago it occurred to the Prime Minister that I might be a suitable person to be made the chairman of a Royal Commission on taxation, and no sooner had his intention been made known than shrieks of indignation arose in certain quarters, apparently on the ground that as I had been once chairman of the Board of Inland Revenue and also had been Chancellor of the Exchequer, and had at various times expressed some opinions about some of the matters the Royal Commission would have to investigate, I was obviously incapable of forming independent judgement on such matters.

By way of contrast, when I was announced as the prospective chairman of the Committee on the floods there was not a word of criticism. There was no one to be found anywhere who would allege with any appearance of truth that I knew

anything at all about the subject! That is how we sometimes do things in this country.

At least I would make the plea, that advanced in years though I am, I am perhaps not wholly incapable of learning, and as the Committee have already had three meetings all devoted to the subject on which you have been addressed this evening I can perhaps claim to know something about this particular aspect —and it is only one aspect—of the problem.

Let me see whether the statement I have just made is in your opinion justified, because you have heard in the space of less than an hour all that I have been trying to learn during three whole meetings of the Committee, and if you have been listening intelligently, as I am sure you have, you will know the matter is not at all free from complication.

Superimposed on the spring tides—which are high tides, as you all know, and indeed as I myself knew beforehand—is a thing called a surge. I am bound to say that until the other day I had never even heard of a surge; but a surge as we now know is a sort of wave which is started by certain meteorological conditions and which proceeds along the coast at exactly the same rate as the ordinary crest of a tide, and it is the surge superimposed on the tide that causes these unfortunate happenings that have been described to us so graphically.

However, it is not so simple as that because we on the Committee have to consider not only the surge superimposed on the tide; we have to consider the effect due to the rotation of the earth which tends to throw the tide to the west and therefore to accentuate the effect. One has to consider also whether the wind happens to be on-shore or off-shore. If it is on-shore, which we are told is an unlikely condition, it tends to accentuate the effect of the high water, and vice versa, but if there had been flooding and if there is an accumulation of water on the in-shore side of an embankment the wave action with an off-shore wind may break the embankment down from the inside and, by breaking the embankment down, do what the direct attack of the flood has failed to do.

There is always the possibility that the flooding effect of a high spring tide with a surge superimposed and a wind in the wrong direction may be further accentuated by an accumulation of flood water. That, fortunately, did not occur during the recent flooding, when the surge did not happen to coincide with the highest spring tides and, therefore, grave though the disaster was, it was on the whole less than it might have been.

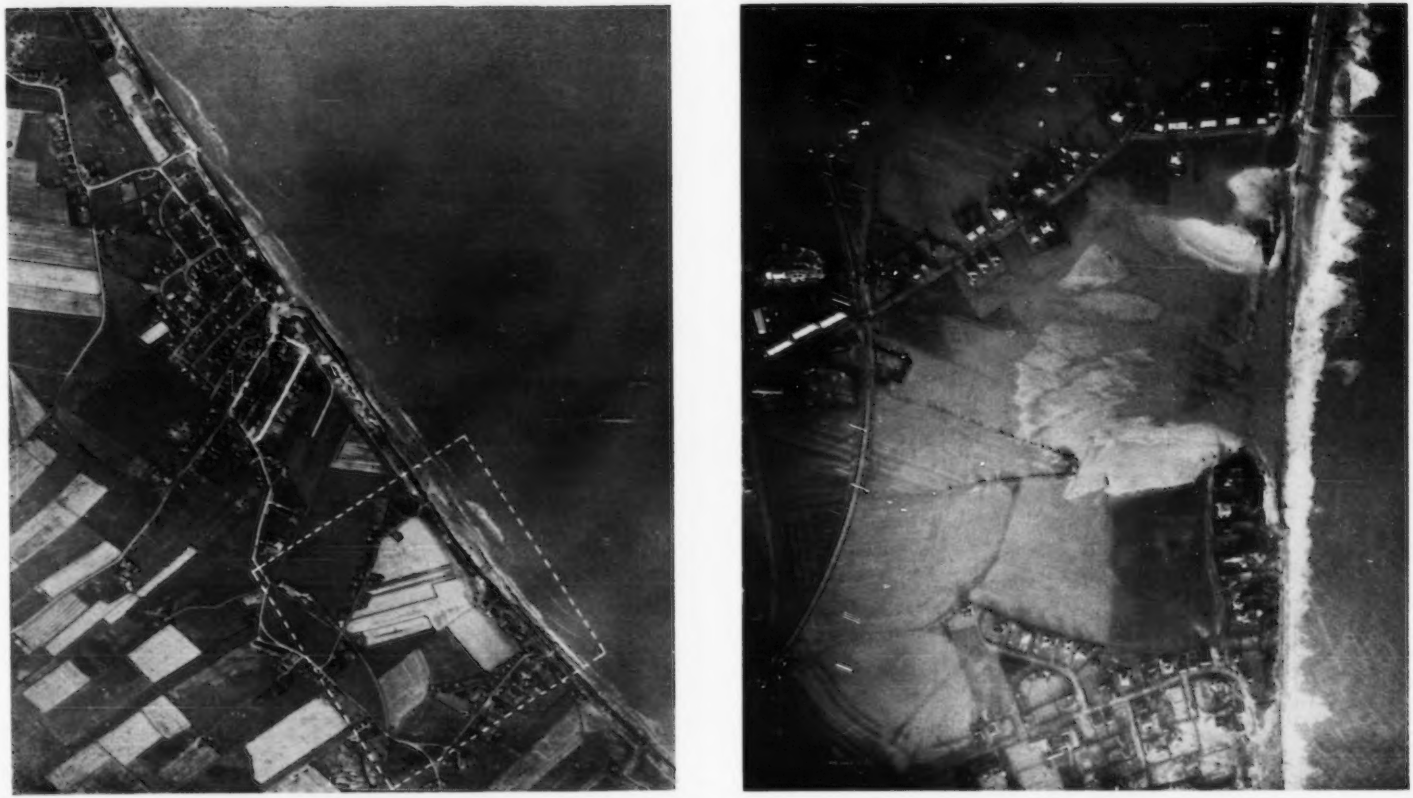
Now I hope I have proved to you that I am beginning to learn something about the subject. I think I may prove a fairly apt pupil. Anyhow, the subject is most interesting, as you will all agree; it is not only interesting, it is of vital importance, and I am sure I shall be echoing the opinions of you all when I say how much we have appreciated the very clear exposition to which we have listened and the quite admirable photographs and charts that have been exhibited on the screen. I do not know how it was possible; we know Professor Steers got up early on the morning of the floods to collect information, but how he managed to get all those extremely vivid and clear pictures passes my comprehension.

We shall continue on the Committee, assisted greatly I know by Professor Steers. He has said very little so far on the Committee. He was apparently saving it all up for you, and I am sure we wish to thank him very much indeed.

Sir DAVID BRUNT: I had the advantage of seeing the script of this lecture over the week-end but not of seeing the photographs which we have seen tonight, which I have just seen for the first time with you and which to me at any rate brought a first vivid realization of what the whole problem was about. I spent a great part of last Sunday reading Professor Steers' lecture and looking at

The bend of the Alde at Slaughden, before the storm, groynes just visible

The bend of the Alde at Slaughden, after the storm. Note breaches in the wall, driving-in of shingle along beach, and exposure of groynes



Sutton-on-Sea, before and after the storm. Possibly the largest single breach (about 300 yards wide) made by the storm

Scolt Head, Norfolk: the foreshore dunes were cut away the distance between the two figures and the dune foot

Gap at landward end of the Great Wall along western side of Wells Harbour

East from Waxham: dunes have been much reduced in width. Low ledge between third and more distant groynes was covered by dunes before the storm. Brushwood groynes are new

Beach at Sutton-on-Sea after the storm

various other documents that had a bearing on this problem. Curiously enough, I had to spend the whole of Saturday in preparing a memorandum on the fogs of December, and I could not help marvelling at the fact that we in this country have been faced with two such major disasters within less than two months. One was due to the fact that a region of light winds in the centre of an anticyclone stayed put for a day or two too long; the other, because over the North Sea we had for too long a time very strong winds from the north.

I do not think Professor Steers has left very much for me to say from the meteorological point of view because he has talked very completely on what we know about it. The whole question of the conditions which led to the formation of these surges was, as far as I can remember, first discussed by Doodson and J. S. Dines in a geophysical memoir published by the Meteorological Office in about 1928. They came to certain conclusions as to the conditions in which these heavy surges should occur, but as far as my memory serves me correctly Dines held that the conclusions to which they had come in discussing former observations did not lay down a method for forecasting which should be regarded as accurate. I think Dines wisely realized the danger that if you forecast, say, three or four times in succession a danger which does not arise you will have cried "Wolf!" once too often and people will pay no attention in future.

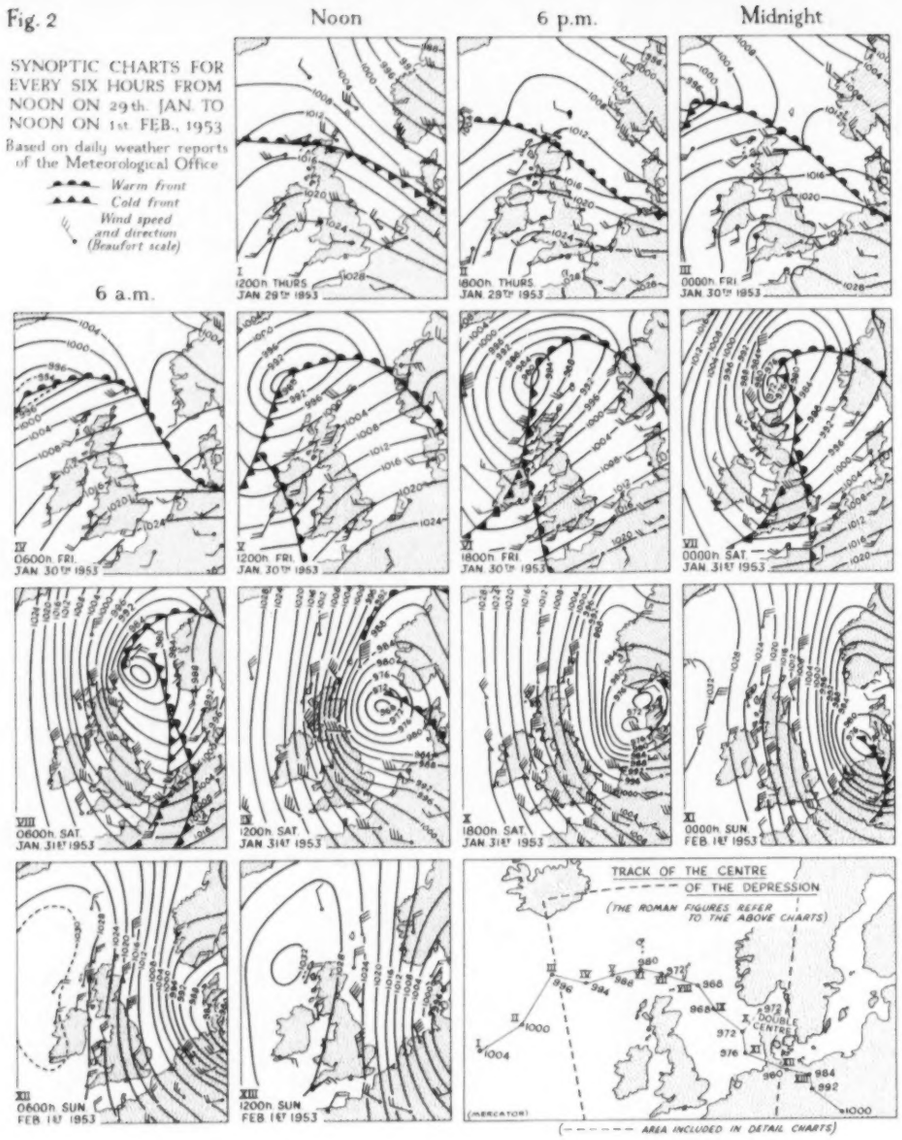
There are, of course, certain uniform conditions to be found whenever you get heavy surges. They tend to become worse if there is an anticyclone centred to the west of Ireland. That produces a condition in which depressions coming from the Atlantic, first travelling north-eastwards, swing round the north of Scotland and down into the North Sea. But even when you know that, you do not know how intense the depression is going to be when it gets into the North Sea, so it is still a perilous business to try to forecast. As one who was at the Meteorological Office I can say that a forecaster's heart knoweth its own bitterness. It is dangerous to forecast anything, whether it be the bank rate or tomorrow's weather. I do not feel that there is any safe method of forecasting the coming of these surges at the moment except by waiting until the surge has appeared, say, off the east coast of Scotland and is on its way down the North Sea. That would naturally permit a forewarning of eight or nine hours but even then one cannot be sure that the surge will not die out before it gets to the southern part of the North Sea.

In so far as I speak as a meteorologist, I do feel that here is an enormously important problem which needs a considerable study of past observations before one can give any final decision. A certain number of pronouncements by Doodson and in particular by Dr. R. H. Corkan, who unhappily died early last year, do lay down some definite knowledge as to what happens during the period of formation of these surges, but still I feel we have not yet got to the stage where we can forecast with any real accuracy what is going to happen.

It is true that floods in the Thames Estuary have been forecast over many years—I think the forecasts were started toward the end of 1928—and a great many of the floods which have taken place in the Thames Estuary have been foretold and efficient warnings have been given out. I am not aware, in fact, that the Meteorological Office has ever been asked to consider specifically the issue of warnings for any region but the Thames Estuary. I speak subject to correction, and there are no doubt others here who can correct me if I am wrong, but I cannot remember that in the days when I was associated with the office there was any specific instructions for consideration to be given to the east coast.

In conclusion, I very much thank Professor Steers for a very interesting lecture, and I should like to add that I wish Lord Waverley and his Committee all success in their deliberations.

Fig. 2


Noon
6 p.m.
Midnight
SYNOPTIC CHARTS FOR EVERY SIX HOURS FROM NOON ON 29th. JAN. TO NOON ON 1st. FEB., 1953
Based on daily weather reports of the Meteorological Office
Warm front
Cold front
Wind speed and direction (Beaufort scale)
6 a.m.
I 1200h. THURS. JAN. 29th 1953
II 1800h. THURS. JAN. 29th 1953
III 0000h. FRI. JAN. 30th 1953
IV 0600h. FRI. JAN. 30th 1953
V 1200h. FRI. JAN. 30th 1953
VI 1800h. FRI. JAN. 30th 1953
VII 0000h. SAT. JAN. 31st 1953
VIII 0600h. SAT. JAN. 31st 1953
IX 1200h. SAT. JAN. 31st 1953
X 1800h. SAT. JAN. 31st 1953
XI 0000h. SUN. FEB. 1st 1953
XII 0600h. SUN. FEB. 1st 1953
XIII 1200h. SUN. FEB. 1st 1953
TRACK OF THE CENTRE OF THE DEPRESSION
(THE ROMAN FIGURES REFER TO THE ABOVE CHARTS)
DOUBLE CENTRE
(MERCATOR)
(------ AREA INCLUDED IN DETAIL CHARTS)

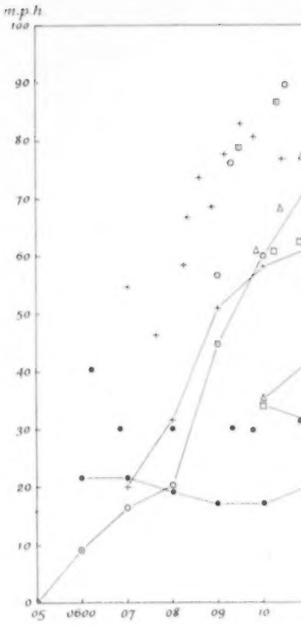
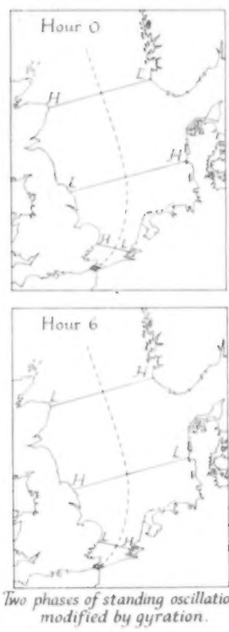
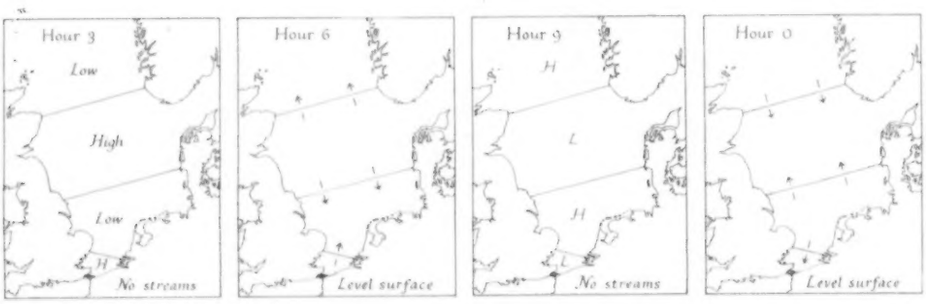


Fig. 3

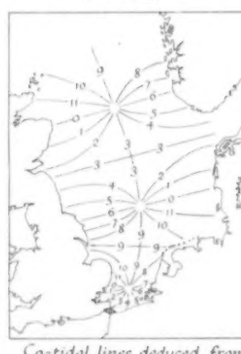


Two phases of standing oscillatio modified by gyration.



Four phases of standing oscillation in the absence of gyration in the North Sea.

Fig. 5



Co-tidal lines deduced from particular phases of standing oscillation, modified by gyrat

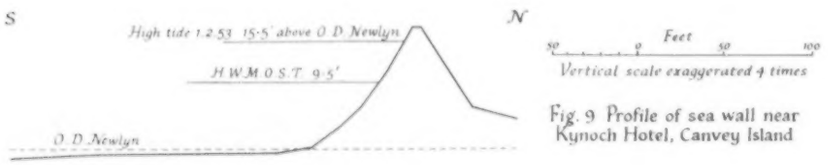


Fig. 9 Profile of sea wall near Kynoch Hotel, Canvey Island

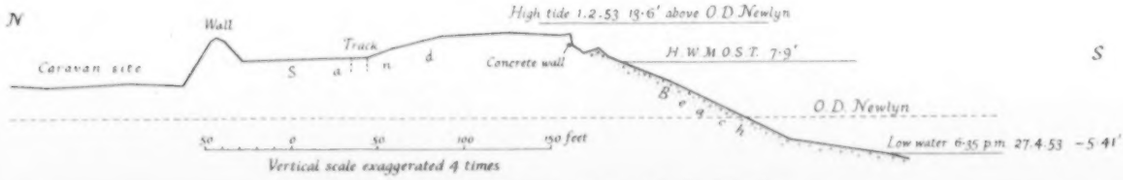
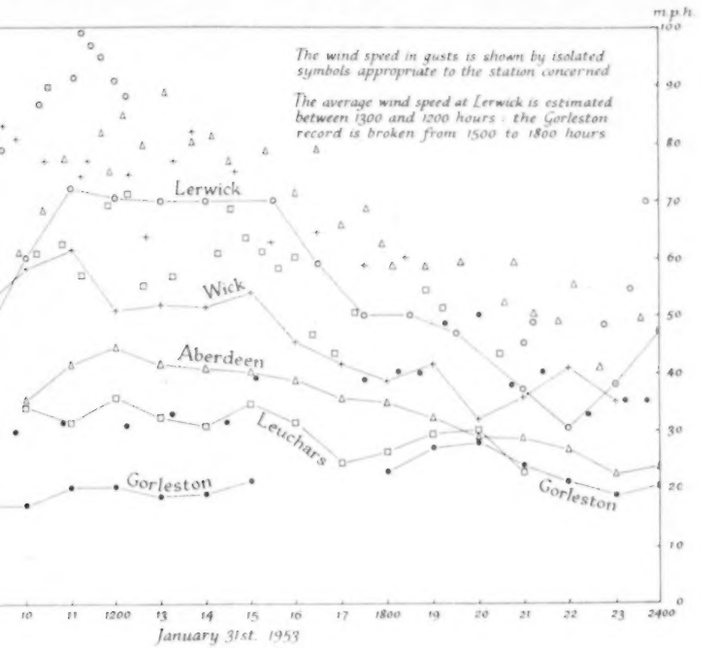


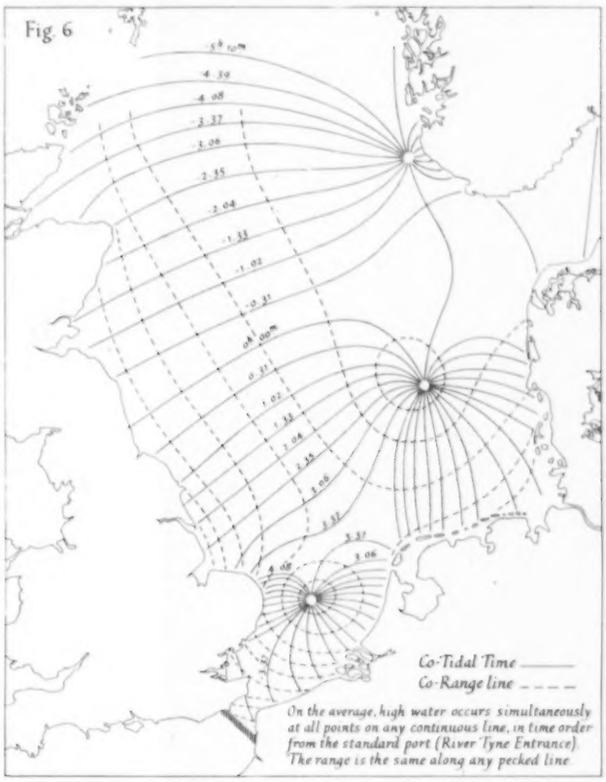
Fig. 8 Profile of wall and beach at Seawick, St. Osyth


m.p.h.
The wind speed in gusts is shown by isolated symbols appropriate to the station concerned
The average wind speed at Lerwick is estimated between 1300 and 1200 hours : the Gorleston record is broken from 1500 to 1800 hours
Lerwick
Wick
Aberdeen
Leuchars
Gorleston
Gorleston
January 31st. 1953

THE EAST COAST FLOODS OF JANUARY 31 – FEBRUARY 1 1953

Professor J. A. Steers

Fig. 6


Co-Tidal Time
Co-Range line
On the average, high water occurs simultaneously at all points on any continuous line, in time order from the standard port (River Tyne Entrance). The range is the same along any pecked line

oscillation,
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standing
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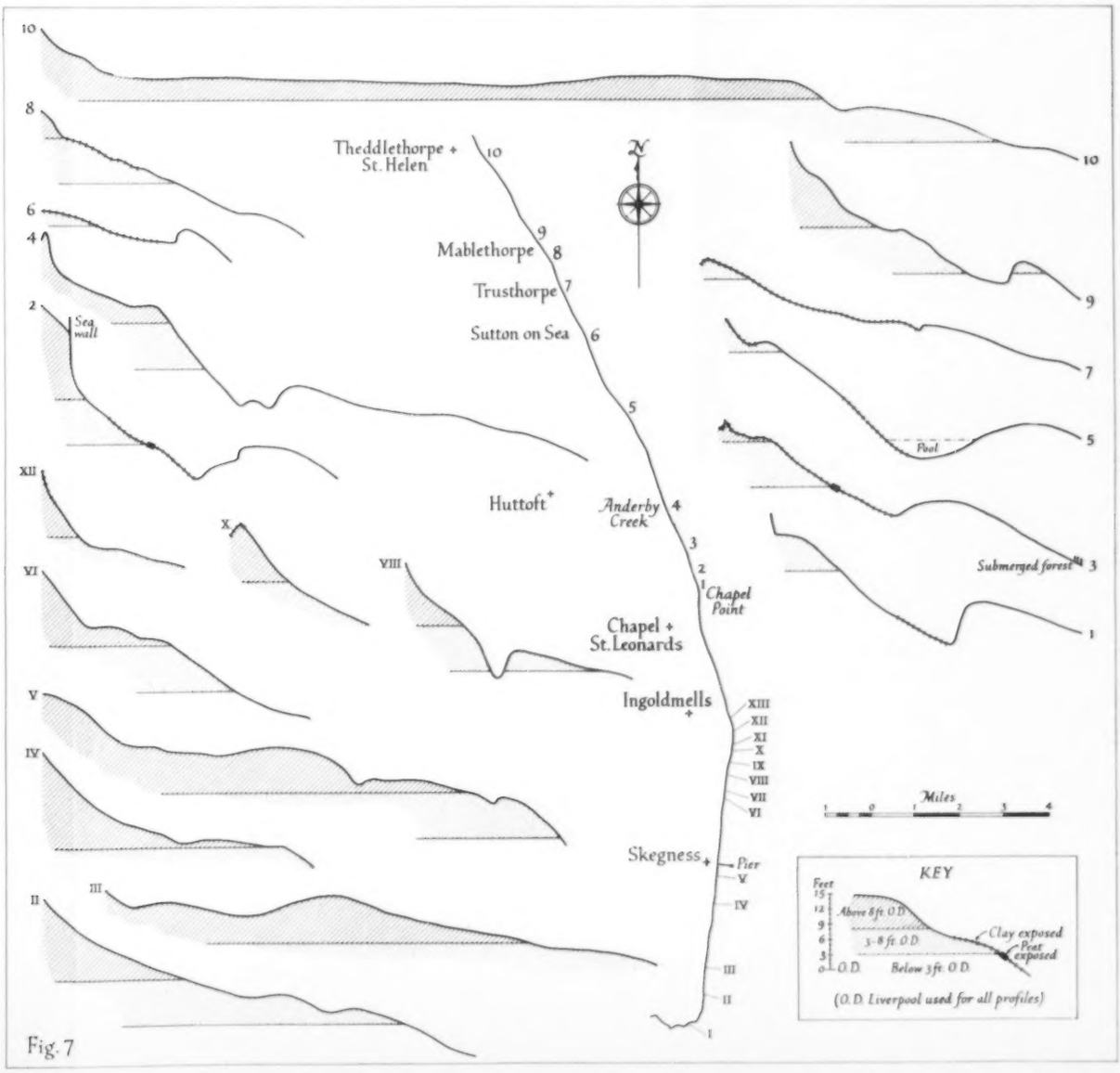


Fig. 7

Mr. W. W. WILLIAMS: I happened to be on the east coast at the time of this storm quite by chance, because periodically I survey a part of it, near Lowestoft, which is being eroded so fast that no one is foolish enough to live there. Even though I saw the beginning of the storm on the Saturday, I did not suspect that it would be as severe as it was, because the winds appeared to be too much from the west. The amount of damage which I observed during the night is interesting.

I surveyed a section at 4 o'clock on the Saturday afternoon, and by 9 o'clock on the Sunday morning the 30-foot-high cliff had been cut back 30 feet. At another point where the cliff is 7 feet high it had been cut back 86 feet, which you will realize is an extremely rapid rate of erosion. This might have caused serious damage had it not been well known that the coast is subject to rapid erosion, so that no houses or buildings have been erected there.

It was interesting to observe the general wasting of beaches; they were stripped of much of their sand, and in a few cases material was thrown inland. I suspect that this movement was confined to shingle ridges, because there is little evidence that sand was carried shoreward. It must therefore have gone some little distance to seaward, as one would expect. The French a year or two ago were troubled because that happened to an alarming extent on many of their beaches, including Deauville. This was serious, because a mud beach has few attractions for holiday makers and the Deauville authorities went to the length of transporting sand to their beach in carts. I am of the opinion that their sand will come back. These violent storms take material to seaward for reasons which are understood, and it is to be expected that a spell of calmer weather will bring it back, though, of course, at a much slower rate. Indeed, I have already observed clear evidence that East Coast beaches are being built up again, and this is a matter of very great importance for many reasons. Obviously it replaces a piece of England which was lost, and it is nice to have it back again! But also, as I see it, it affects the very vital problem of the heights to which defences need to be built.

Professor Steers pointed out that when a beach is very flat a given amount of wave energy is dissipated over a wide area, so that the damage done is very small, but on a steep beach the same energy is spread over a narrower belt, and also *the waves reach to a greater height* up the beach.

On a flat part of the coast where the height of the surge was 8 feet above the predicted tide level, I found the drift line at exactly this level; but in another place, where the wave energy had not been dissipated, the waves were reaching to heights 8 or 10 feet above the mean water level. And, of course, water was flung high over sea walls.

I feel that this question of the height to which wave action may reach is of very great importance, and one which is difficult to decide, because it depends upon the underwater beach profile which itself changes. Local evidence is not now available, because on two recent excursions I have found that bulldozers—which have a useful function I believe—have removed all trace of drift lines, so that there is no continuous record on the ground of the heights to which the sea did in fact reach.

The PRESIDENT: If no one else wishes to take part in the discussion I will thank Professor Steers on your behalf for his very excellent lecture.

PRESENT VERTICAL MOVEMENTS OF THE BRITISH ISLES

HARTMUT VALENTIN

THE LONDON FLOODS of 6–7 January 1928, the Horsey floods of 12 February 1938, and now the great flood disaster of 31 January 1953, in which 307 people lost their lives and enormous damage was done in eastern England, make it important to consider if these floods were possibly connected with a slow submergence of the country. It must, of course, be realized that the abnormal heaping up of waters by the storm on 31 January far outbalanced any downward movement of the land in relation to mean sea level—yet any such change of level is continuous and must be allowed for in terms of long period.

There were two geodetic levellings of England and Wales; the first from 1840 to 1860 and the second from 1912 to 1921. Unfortunately, no firm conclusions can be based on the differences found between them. The Ordnance Survey itself ascribed the discrepancies mainly to the errors in the first levelling.[1] British tide-gauge records, on the other hand, have as yet rarely been used to determine the present changes of level. R. Witting incorporated the readings at Aberdeen and Dundee in his classical investigation of the vertical movements in the Baltic and North Sea.[2] T. E. Longfield seems to have been the first to call attention to the rise of the mean sea level at Felixstowe [3] which, together with a similar rise at Newlyn, made H. L. P. Jolly suppose a land subsidence in the south of England.[4] These data and the values calculated by B. Gutenberg [5] were worked up by the present writer in his treatise on the coasts of the earth.[6]

In the present paper the annual mean heights of sea level at the ten tide-gauge stations of Aberdeen, Dundee, Dunbar, Felixstowe, Newlyn, Avonmouth, Holyhead, Liverpool, Douglas and Dublin are analysed. The figures were published [7] up to and including the year 1946 by the Association

[1] Close, C. F., "The second geodetic levelling of England and Wales, 1912–21" London (1922), H. M. Stat. Off., 5.

[2] Witting, R., "Hafsytan, geoidytan och landhöjningen utmed Baltiska hafvet och vid Nordsjön." *Fennia*, 39, 5 (1918), 271.

[3] Longfield, T. E., "The subsidence of London." *Prof. Pap. Ordn. Surv., Lond.* N.S. 14 (1932), Plate II.

[4] Jolly, H. L. P., "A supposed landsubsidence in the south of England." *Int. geogr. Congr. Amsterdam*, 2, 2b (1938) 56, and "Supposed land subsidence in the south of England." *Geogr. J.*, 93, 5 (1939) 408.

[5] Gutenberg, B., "Changes in sea level, postglacial uplift, and mobility of the earth's interior." *Bull. geol. Soc. Amer.*, 52, 5 (1941), 729.

[6] Valentin, H., 'Die Küsten der Erde. Beiträge zur Allgemeinen und Regionalen Küstenmorphologie.' *Petermanns geogr. Mitt., Ergänzungsh.* 246 (1952) 67, 81, Plate 2.

[7] Association d'Océanographie Physique, "Monthly and annual mean heights of sea-level. Up to and including the year 1936." *Publ. sci. Ass. Océanogr. phys.*, 5 (1940) 114, and "Monthly and annual mean heights of sea-level. 1937 to 1946 and unpublished data for earlier years." *Publ. sci. Ass. Océanogr. phys.*, 10 (1950) 42.

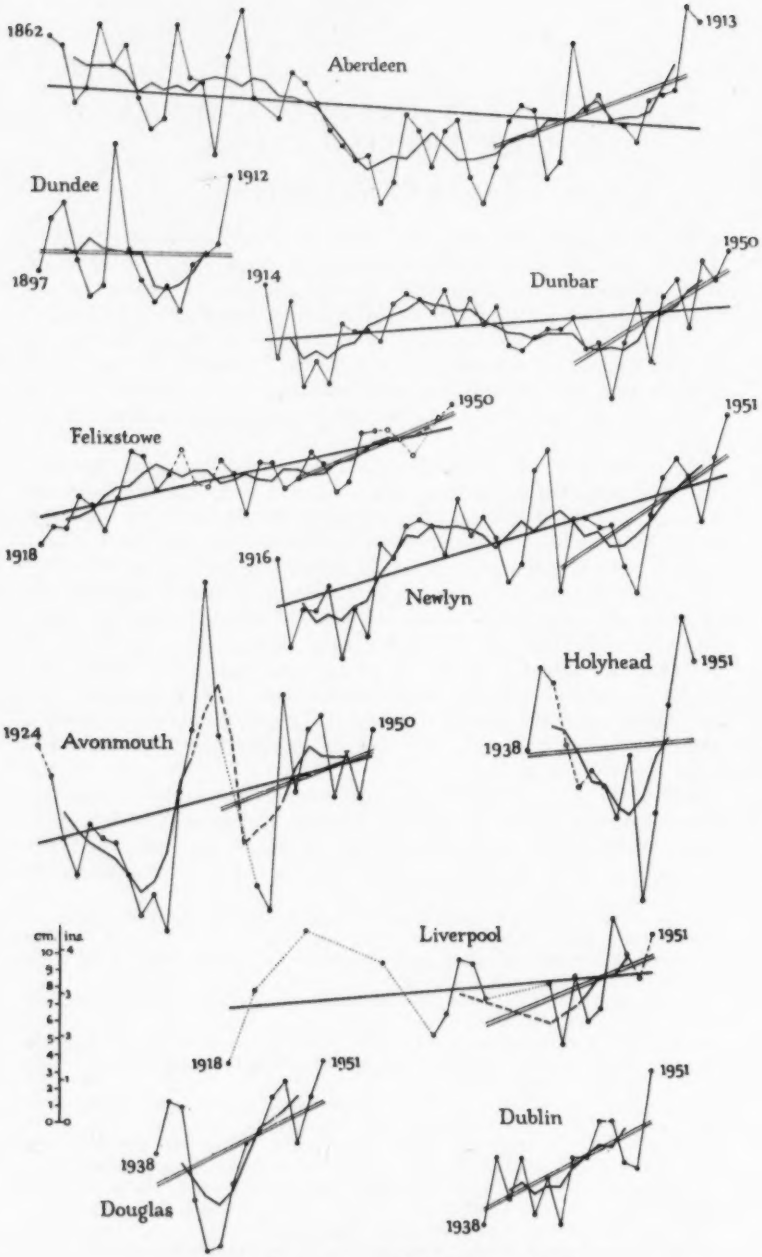


Fig. 1. Annual mean heights of sea level

d'Océanographie Physique. The writer is greatly indebted to Dr. A. T. Doodson, Director, Liverpool Observatory and Tidal Institute, Captain F. Ardern, District Marine Manager and Harbourmaster, Holyhead, and H. T. Matthews, Secretary, Isle of Man Harbour Board, Douglas, all of whom kindly provided unpublished data from 1947 to 1951.

There are several gaps in the series of the annual means because the readings for various months are missing. Some of them can be filled by using the available monthly means. The annual mean cannot simply be computed by averaging the 11, 10 or only 9 existing monthly means; to obtain a reliable value a correction allowing for the typical sea level conditions during the missing months must be made. For example, at Felixstowe the means of January to September, 1930, give an average of 13·509 feet, yet this is obviously too low a value for 1930 since the high-water levels of autumn are wanting. The average of the January to September means for five preceding and five following years is 13·525 feet, and the corresponding ten-year mean amounts to 13·568 feet. Thus the "probable annual mean" for 1930 is 13·509+0·043 feet=13·552 feet. Unfortunately, in some cases there are insufficient monthly means available to fill these gaps. It is a great pity that the records for Liverpool, 1939–42, and Avonmouth, 1939–40, were destroyed during the war, and that the Ordnance Survey discontinued the tide-gauge observations at Dunbar and Felixstowe on 1 January 1951.

In Figure 1 the annual means based on complete sets of readings are marked by black dots and connected by thin continuous lines. The "probable annual means" however, which were computed from incomplete series of observations, are shown by open circles and connected by a thin broken line. Gaps are bridged by dotted lines. The annual mean heights of sea level vary considerably from one year to the next—in an extreme case by as much as 0·42 feet. (Avonmouth, 1942/43.) These fluctuations are mainly the result of the differing meteorological conditions from year to year. In order to eliminate the effect of these conditions and bring out the general trend more clearly, overlapping five-year means have been calculated. They are plotted and connected by stronger curves which are broken where gaps in the annual means occur. These curves reveal an interesting oscillation of sea level, with prominent troughs in about 1890, 1920 and 1942, correlated with recent glacier and wind variations.[1]

The author has also calculated overlapping ten- and nineteen-year means, which are not reproduced here. The ten-year means show similar oscillations to the five-year means, but their amplitude is smaller. In the curves of the nineteen-year means however all lesser fluctuations than the 1890 trough at Aberdeen are smoothed out, and the nearly straight lines for Dunbar, Felixstowe, Newlyn and Avonmouth represent approximately the long term change of level at these stations. To obtain a more exact determination of the changes at all ten stations, the regression coefficients were calculated by means of the method of least squares. The results of these calculations are shown in Figure 1; heavy sloping lines representing the long periods and double lines the short periods. The following table gives the numerical results

[1] Valentin, H., 'Gegenwärtige Vertikal bewegungen der Britischen Inseln und des Meeresspiegels.' *Verh. dtsch. GeogrTags Essen* (1953), in press.

and allows comparison with the tide-gauge results from other parts of the world.[1]

Emergence (+) and Submergence (−) calculated by the least squares' method

1	2	3	4	5	6	7
Station	*Time*	*n*	*mm/year*	*Time*	*n*	*mm/year*
Aberdeen ..	1862/1913	52	+0·5±0·3	1897/1912	16	−2·8±1·2
Dundee ..	—	—	—	1897/1912	16	+0·1±1·5
Dunbar ..	1914/1950	37	−0·5±0·3	1938/1950	13	−4·7±1·4
Felixstowe ..	1918/1950	32	−1·7±0·2	1938/1950	12	−3·2±0·8
Newlyn ..	1916/1951	36	−2·3±0·4	1938/1951	14	−5·2±1·5
Avonmouth	1924/1950	25	−2·0±1·2	1938/1950	11	−2·9±3·6
Holyhead ..	—	—	—	1938/1951	14	−0·7±3·6
Liverpool ..	1918/1951	18	−0·6±0·6	1938/1951	10	−3·1±1·8
Douglas ..	—	—	—	1938/1951	14	−3·8±2·1
Dublin ..	—	—	—	1938/1951	14	−4·0±1·3

In cols. 3 and 6, n=number of annual means; in cols. 4 and 7, regression coefficients ± standard errors.

When the long term changes listed in column 4 are plotted on a map, they demonstrate a systematic decrease from north to south. This suggests that they are primarily caused by a warping of the earth's crust. It would be misleading, therefore, to consider the short period values for Dundee, Holyhead, Douglas and Dublin as well, for they represent only a part of one sea level oscillation. There is however a possibility of using these values in order to extend the map towards the west. At all the six stations for which both the long term change and the short period value have been calculated the latter is much more negative than the former. For Aberdeen the difference is 3·3 mm/year. To obtain the probable long term change for Dundee, this difference is added to the short period value of Dundee (*i.e.* +0·1+3·3=+3·4 mm/year), but a reduction of *c.* 1 mm is made in order to avoid any possible exaggeration: thus the estimated amount of about +2·5 mm/year will certainly not be too positive. For Dunbar, Felixstowe, Newlyn, Avonmouth and Liverpool the average difference between the figures in columns 4 and 7 is 2·4 mm/year. The probable long term changes at Douglas and Dublin would be −3·8+2·4=−1·4 and −4·0+2·4=−1·6 mm/year, respectively, but again a reduction of approximately 1 mm is made, so that the resulting values of about −0·3 and −0·5 mm/year should not be too negative. At Holyhead this would give a high positive figure, yet in view of the great standard error at this station an especially careful statement is preferable.

In Figure 2 the long term changes of level at all ten tide-gauge stations are entered. One isobase only can be drawn with confidence, *i.e.* the zero-line between Aberdeen and Dunbar. The exact situation of the others is uncertain because of the wide spacing of the stations. It is regrettable that no annual

[1] Valentin, H., 'Die Küsten der Erde. Beiträge zur Allgemeinen und Regionalen Küstenmorphologie.' *Petermanns geogr. Mitt., Ergänzungsh.* 246 (1952), 80–84.

means have been computed for the tide-gauges in north-eastern England which could fix the positions of the −1 and −1·5 mm lines. The triangle Aberdeen–Dunbar–Dundee shows a remarkable gradient towards the Scottish Highlands, where a strong emergence seems to be in progress. Its

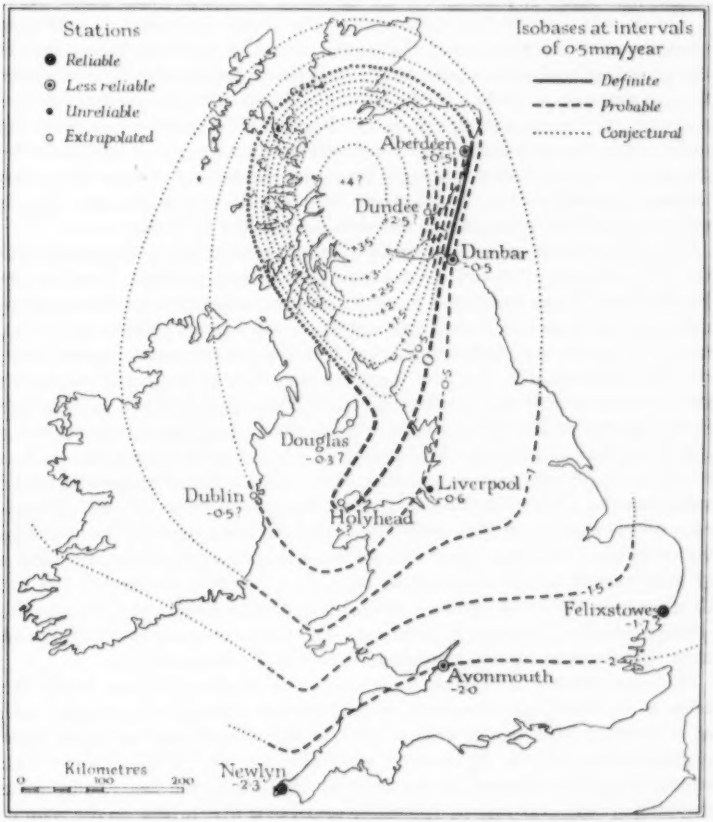


Fig. 2. Present vertical movements of the British Isles in relation to mean sea level, in mm/year (+, land emerging; −, land submerging). To obtain the true crustal movements, the amount of the present sea level rise must be added to all the figures, say, 1 mm/year (land within the −1 mm isobase rising; land outside that line subsiding)

maximum may well reach +4 mm/year, in view of the +2·5 mm/year estimated for Dundee. Thus conjectural isobases were drawn around the Highlands.

The map shows the probable present movements of the British Isles in relation to mean sea level. These movements will sooner or later be important

in a practical way. The strong emergence in Scotland, for instance, will eventually be felt by the shallowing of the harbours, and the submergence in southern and south-eastern England must contribute to coastal floods—especially when its effect is increased by the periodical sea level rise, as before 1928 and 1953.

For purely scientific aims, however, it is more significant to know the absolute vertical movement of the earth's crust. In that case the amount of the present glacial eustatic rise of sea level has to be added to all the figures, *i.e.* 1–2 mm/year according to the latest computation.[1] If one admits only 1 mm/year, the maximum uplift in the Highlands is about 5 mm/year, the uplift along the zero-line is still 1 mm/year, and the −1 mm isobase is the hinge line of the crustral warping. Thus the whole land within the 1 mm isobase is actually rising, but its coast between the −1 and 0 mm lines is submerging slightly because of the simultaneous sea level rise.

These facts must be borne in mind when the present map is compared with the map showing the differences between the two geodetic levellings of England and Wales completed in 1860 and 1921, respectively.[2] The positive difference of 0·08 feet during the sixty year interval at Dunbar (*i.e.* +0·4 mm/year) agrees very well with the uplift of 0·5 mm/year as computed from the tide-gauge records. On both maps the hinge line of the crustal movement runs from central Wales to north-eastern Yorkshire, and although its course in the interior of the country cannot be checked by tide-gauge observations this is a good accordance. The difference of −0·40 feet between the two levellings at Newlyn (−2 mm/year) is of the same order of magnitude as the subsidence of 1·3 mm/year deduced from the present map. A great discrepancy occurs however at Felixstowe where the difference between the levellings was 1·70 feet (−8·6 mm/year) whilst the reliable tide-gauge readings yield a genuine subsidence of 0·7 mm/year only. It is therefore concluded that the differences in the north and west of the country were largely produced by the tilting of the land, but that the enormous differences in south-eastern England must mainly be attributed to regional errors in the first levelling.

The true crustal movements have also to be considered when finally the cause of the changes is discussed. Glacial isostasy certainly plays a great role, as is shown by the fair correspondence of the present map with the latest reconstruction of the Pleistocene ice-sheets on the British Isles.[3] The strongest uplift is located in the Scottish Highlands, the last region to be deglaciated; the oval-shaped updoming south of it may be due to the waning of the thick Irish Sea ice; and the hinge line, *i.e.* the −1 mm isobase of the map, follows roughly the limit of the last glaciation, suggesting that this glaciation was separated from the last Scandinavian ice-sheet. South of the hinge line, the small subsidence up to the −2 mm isobase which corresponds closely

[1] Valentin, H., 'Die Küsten der Erde. Beiträge zur Allgemeinen und Regionalen Küstenmorphologie.' *Petermanns geogr. Mitt., Ergänzungsh.* 246 (1952) 84.

[2] Close, C. F., "The second geodetic levelling of England and Wales, 1912–21" (1922), Plate III. Longfield, T. E., "The subsidence of London," *Prof. Pap. Ordn. Surv., Lond.* N.S. 14 (1932), Plate I.

[3] Wills, L. J., 'A palaeogeographical atlas of the British Isles and adjacent parts of Europe.' London and Glasgow, Blackie (1951) 60, 62.

with the limit of the maximum glaciation, and the greater sinking in that part of southern England which was never covered with ice, could both be the consequence of a compensation current in the magmatic substratum.

It is possible however that the present movements are partially a continuation of even older events. The area of uplift coincides with the great dome-shaped elevation, associated with rifting and volcanism during Tertiary times, which was recognized by the late German geologist H. Cloos.[1] Indeed, the isobases of the present map are similar to the contours of the sub-Cenomanian surface reconstructed by D. L. Linton.[2] Eastern England, on the other hand, may still be taking part in the subsidence of the North Sea basin as it has been doing since the Pliocene.[3] There is no such simple non-isostatic explanation of the sinking in southern England, if the English Channel is regarded as created by mere river and sea action. Yet a slow subsidence would help to account for the formation of the wide Channel, for its permanent water filling in the recent geological past (except during the glacial eustatic lowerings of sea level), and perhaps also for the north–south shift of the River Solent as demonstrated by S. C. Everard.[4] If this is so, all the present vertical movements of the British Isles would date from preglacial times, but they were much intensified by the effects of the Quaternary Ice Age.

[1] Cloos, H., "Hebung—Spaltung—Vulkanismus. Elemente einer geometrischen Analyse irdischer Grossformen." *Geol. Rdsch.* 30, 4A (1939) 500, 512.

[2] Linton, D. L., "Problems of Scottish scenery." *Scot. geogr. Mag.* 67, 2 (1951) 70.

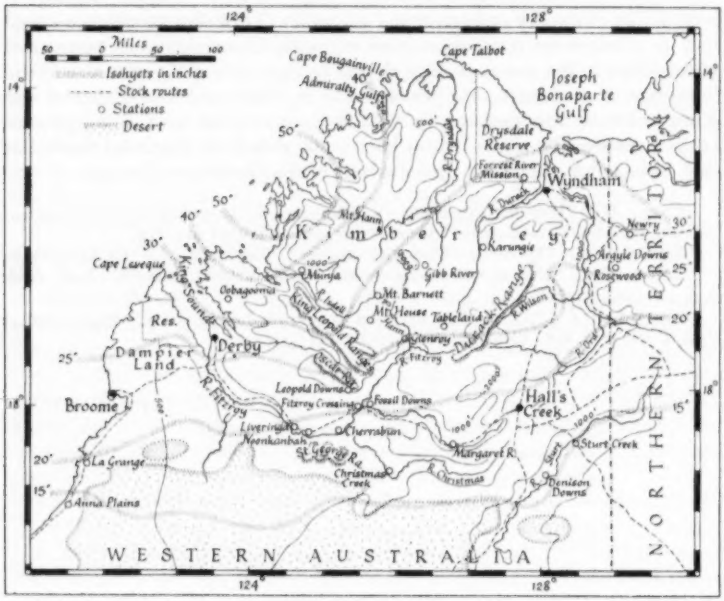
[3] Valentin, H., "Der Nordseeraum an der Wende Tertiär/Quartär." *Erde, Berl.* 3, 3–4 (1951/52) 288.

[4] Everard, S. C., "The Solent River—a geomorphological study." Paper read at Ann. Conf. Inst. Brit. Geographers, London (1953).

THE KIMBERLEY DIVISION OF WESTERN AUSTRALIA

LORD RENNELL

THE NORTHERN PART of Western Australia is the largest partially developed area readily available for stock raising on an immensely increased scale in Australia. Although stock is already raised and exported to other parts of the continent and overseas by way of Broome and Wyndham much of the de-



Northern Western Australia

velopment has not progressed substantially since the beginning of the century, and vast areas capable of raising stock have not even been taken up. What is produced is no measure of what could be produced. This backwardness is essentially due to lack of communications.

Northern Western Australia lies in the southern monsoon belt of the East Indies. So does northern Queensland. But in northern Western Australia the vagaries of the monsoon at the southern edge of the belt are less marked than in those parts of northern Queensland which are suitable for cattle. Even in 1951–2 and 1952–3, the former a year of fearful droughts almost everywhere in Australia entailing heavy losses of stock, some rain fell in the

Kimberleys, and probably in time to save most of the breeding stock, even if the rainfall was much less than normal.

Several large rivers, the Fitzroy, the Margaret, the Orde and the Drysdale run through the Kimberleys. In normal rainy seasons these rivers run continuously throughout their courses; but what is even more important is that their channels contain water all the year round. The Geicke gorge of the Fitzroy has deep permanent water over many miles. Nearly all the larger stream beds have available water which could be developed with wind or Deisel pumps, or retained by small dams, if capital were available and the lack of communications had hitherto not made the cost of development prohibitive.

It is very attractive country which proved a magnet for early settlers as long ago as the 1880's, when the first of the great pastoral leases of 1,000,000 acres each were granted by the government at Perth. Since those days, very little real development has taken place.

The drawback about Western Australia is that the government has never had access to enough money to do more than a fraction of what ought to be done. The Commonwealth Government has its hands full with the Federal Northern Territories and with the insatiable demands for Commonwealth help from New South Wales and Victoria, which contain so large a proportion of the taxable resources of Australia.

The result is that the 1,000,000 acre cattle stations in northern Western Australia are still run on the romantic but uneconomic open range system of ranching which came to an end, substantially, in the United States of America, Canada and the Argentine two generations ago. Open range ranching may be economical in capital and wages, but it is thoroughly uneconomic in results. Vast unfenced areas must be under-developed for cattle or sheep, because there is no possibility without control by fencing to prevent areas near open permanent water from becoming overgrazed: to ensure that all the unwanted bulls are rounded up for castration: and, in the absence of created water supplies, to get cattle into suitable condition for killing. If as well as this there are no roads or railways and very rough country to cross along the stock routes, the quality of the cattle which can be got to seaboard shipping points will not command good prices. Open range ranching therefore produces poor returns which have been accentuated by the low prices which the export market has offered and which our Ministry of Food, notably, still offers. The "stations" in northern Western Australia have thus for thirty years been unable to obtain enough capital, without which they cannot develop out of their present condition. The result is a vicious circle. These generalizations do not of course apply to all the stations in northern Western Australia, though lack of communications affects every one of them.

As country the Kimberley district is definitely good. The valleys are well clothed with trees, scrub and good grass. The bird life is copious and interesting. In February 1951, when little rain had as yet fallen, the creeks were full of bustard (turkey), duck, cranes, and of course parrots and parrakeets. There were too many kangaroos for the pastoralists, but happily not too many dingoes and very few rabbits. There were also quite a lot of wild horses, donkeys and pigs: the latter are mainly of Tamworth ancestry; they were

introduced by early settlers and are reproducing themselves in the bush. Plenty of fish live in the permanent water. Even sharks sometimes come up the Fitzroy in flood and get landlocked in the fresh water of the Geicke gorge. A friend of mine recently caught one six feet long.

The broad valley bottoms of the Central Kimberleys lie at a height of between 750 and 1000 feet. The mountain ranges are well over 2000 feet. In this country the hills rising out of the river plains generally have flat tops and steeply sloping sides covered with scree and loose rock. But many of the ranges themselves have already been denuded by rain and wind erosion into rugged spiky arêtes with little vegetation and a lot of loose rock and desiccated rain channels. It is the broad alluvial valleys between the hills which provide the vegetation cover for stock feed and animal life. In these valleys the slower flowing water-courses retain water, either free or in sand, all the year round. But the stock routes which cross the mountains, especially the Oscar, Durack and Leopold ranges, are so hard on cattle, especially on their feet, that only six or seven year old animals can be driven to the coast for slaughter, or for export on the hoof by sea to other Australian ports. Droving is a hard life and it is becoming more and more difficult to find drovers today; droving out of the Kimberleys is notoriously hard even in Australia.

Most of the "stations" in the Kimberleys are cattle stations. But before considering what a station in this area consists of, it is well to try to visualize what a million-acre plot of land is like in terms with which we in this country are familiar. 1,000,000 acres is 1562½ square miles: or say an area 100 miles long by 15½ miles broad: or again an area 60 miles long by 26 miles broad. Such an area would extend from the middle of London to the coast at Brighton and have a breadth of 30 miles. My own county of Herefordshire covers 550 square miles, which would be about one-third of a million-acre station in the Kimberleys.

One notable exception in a cattle district is Noonkumbah Station in the Fitzroy Crossing group. The "crossing" incidentally is a concrete washover where the river can be crossed—usually—in the rainy season or "wet." Noonkumbah has benefited a great deal, not only from good management and access to capital but especially from the high price of wool for some years past. Stations hereabouts are either sheep or cattle: local opinion holds that you cannot find men who really understand both. Many stations also breed horses mainly for their own use. At Noonkumbah there has been a good deal of development in fencing and drilling boreholes for wind pumps. The fencing is not for the main boundary, but to make what the Australians call "paddocks." Now a paddock in the Kimberleys is quite a place. I listened to an animated debate at Noonkumbah on the economics of 4 by 4 as opposed to 9 by 9 paddocks, the unit being miles! Perhaps this is not surprising when your station covers 1500 square miles with more or less undefined boundaries or a range of hills which gradually peter out into the dead heart of Australia. Paddocks are fenced to control grazing and to facilitate rounding up and sorting stock for branding or shearing, culling for slaughter or castration, and killing off old or debilitated animals which are no use for breeding or eating. The fencing is composed of strands of wire on wooden posts or iron ones when these are available. The latter, of course, are ideal because fences and

Pigs at Mount House Station

Glenroy: beef from chilling rooms being loaded on to aircraft

Glenroy abattoirs from the air

Typical country at Mount House Station

wooden posts disappear in a bush fire and can even be seriously damaged when areas are deliberately fired to clear or cure pastures.

The animal fodder on these stations is green or dry standing grass. Some stations have begun to grow planted fodder including irrigated lucerne for "finishing" stock and for horse feed. Some attempts at grass improvement have also been made by introducing new varieties. Sorghum could be grown most years and there are possibilities for other grain including rice on the coastal belt. But all this development awaits capital, which awaits more remunerative returns, which can only be got with more capital development—and perhaps more foresight by several government departments, not only in Australia.

Work on the stations is done by a handful of white men and the aborigines or "blacks," which term usually includes some halfcastes. White hands are getting more and more difficult to find. Primitive living conditions, remoteness and lack of communication have contributed a lot to the drift away from these Kimberley stations. Only capital for development, especially in housing, can reverse the trend except among those, happily still fairly numerous, men who like the life. The supply of aboriginal labour however is adequate for what is wanted on stations where the management is good. The Australian native, primitive as he is in many respects, has taken well to stock work and horses. Without native labour most of the remoter cattle stations would long since have had to close down. While theoretically the native labour is a floating population which can and does come and go, most stations have a static population of natives out of which a comparatively large proportion is "on the strength" drawing for themselves, and in many cases their dependants, food, tobacco and clothing. But they live in almost unbelievably primitive conditions. It is hard to generalize about them except to say that too few Australians have tried to understand or train them beyond the minimum required for stock work at which they have proved their worth and their competence.

What is the future of this very attractive country? Frankly, roads and railways are too expensive to-day for areas like the Kimberleys. Roads suitable for economic motor transport would not only have to be metalled but sealed with tar or bitumen to survive rainy seasons with 40 inches falling near the coast and 24 inches in the interior in a few weeks between November and April. Hundreds of miles of main roads would be needed, with several more hundreds of miles of feeder roads, crossing innumerable creeks in great flat valleys where ballast is not everywhere accessible or suitable.

The answer to the problem of communication is perhaps closer at hand than some people realize. It is air transport. The aeroplane has already revolutionized the amenities of station life. Nearly every station already has its airstrip. The Flying Doctor service with the "pedal" or, as usually now, motor driven, radio telephone has brought safety in sickness, and contact with security. The regular station air services once a week or fortnight have brought contact with the outside world. And now in one place air freighting is being tried out, to market cattle by killing them at the station and flying the carcases 160 miles to a seaboard freezing plant in order to save 350 miles of travel over the rough and arduous, overgrazed and under-watered, droving

roads. At Glenroy on Mount House station four years ago an interior abattoir was constructed as an experiment. It was designed to kill 5000 head of cattle in a killing season of sixteen weeks. The installation down to the last screw and sheet was flown in and erected on the spot together with rudimentary accommodation for the seasonal staff. The carcases are chilled to 18° F. and flown out by a Bristol Freighter making two trips a day between Glenroy and Wyndham, where they are held for export. Conservatism, scepticism, jealousies and vested interests provided more than adequate opposition to the experiment ever starting, or continuing after it had started. But last year the plant dealt with over 5000 head and proved itself. The carcases delivered at seaboard were not unnaturally heavier than those of beasts which had walked their way to slaughter. Younger animals could be killed at Glenroy than could be driven to Wyndham or Broome. Animals which could never have stood droving and which otherwise to their owners represented a "write off" could be utilized and showed a higher proportion of first and second grade meat than was ever dreamed of. Moreover last year the Glenroy plant killed cattle for the Mount House and neighbouring stations which could never have been walked at all because the rough stock roads were dry. This plant that season has meant not only a profit for the local station but also revenue for neighbouring stations which they could otherwise never have hoped to see. If in past years similar interior killing stations had existed in Australia, tens of thousands, perhaps hundreds of thousands, of cattle which could not be moved on account of drought and died of starvation could have been turned into meat. At what cost? At the cost to-day of some sixty thousand Australian pounds per plant and a few Bristol Freighters.

The time will surely come when the Kimberleys, and not the Kimberleys alone, will be developed by interior slaughter-houses and extensive air freight. And beyond the Kimberleys is another vast area—the Drysdale, which is as yet untouched and virtually even unknown to the white man. How much metalled and sealed road can be built with bridges or even concrete "washovers" for the amount of English or Australian money today equivalent to one interior slaughter and chilling plant? The answer in remote areas in any continent is virtually nothing. Ten interior slaughter plants at the optimum distance of 200 miles from a holding refrigerator either at seaboard, railhead or roadhead and a rather longer killing season could deal with 100,000 head of cattle for a lesser cost than governments have spent on failing to grow pigs and sorghum in Queensland. Isn't this a better idea than talking and planning roads which no one can afford to build because no adequate supply of capital is available either in the Commonwealth or in America?

There is no doubt that the Glenroy scheme will develop as the economics become apparent even to the most prejudiced. But how much time has already been lost? The Commonwealth Commission on the development of the northwest has now recommended the construction of two new interior killing stations, at Fitzroy Crossing and at Hall's Creek. But this should not wait on private capital which is especially hard to find in a drought-stricken land. The right responsibility for the development of the Kimberleys is for the governments concerned to provide the processing plants and aircraft for interior killed beef, and for the pastoralists to develop their properties out of

their revenues derived from this sort of outlet to produce the cattle in larger numbers and better quality.

DISCUSSION

Evening Meeting, 17 November 1952

Before the paper the PRESIDENT (Mr. J. M. WORDIE) said: It is quite unnecessary to introduce the lecturer this evening in that he is our Past President. Lord Rennell was awarded the Founder's Medal in 1929 and was our President from 1945 to 1948

Lord Rennell then read his paper

The PRESIDENT: We have with us H.E. the High Commissioner of Australia, Sir Thomas White, who knows the region about which Lord Rennell has been speaking.

H.E. the HIGH COMMISSIONER OF AUSTRALIA (Sir Thomas White): We have certainly been given a great treat in that we have been privileged to listen to an address by a skilled observer, one who has chronicled his observations very accurately, and one whom we are glad to know as a lover of Australia who appreciates some of our difficulties and some of our under-development.

One has to realize that the part of Australia that we saw initially, on the map, is so large that these lovely British islands could be put there in thirty-two different places. To give you an idea of distances—Lord Rennell has given some already—it is farther from Sydney to Perth that it is from London to Moscow. You can realize that in the eastern part of Australia and in the southern part from which I come, there is the same kind of development—at least an attempt at it—as you have heard of this evening, because it is the part of the country which has adequate rainfall. It is only because of that that we are Great Britain's main food producers, because Australia supplies more of the food you import than any other country in the world. Yours is a country with a great population which will never be able to feed itself; it must be dependent upon exports from other parts of the world. We in Australia are proud not only to help Great Britain and the other Dominions, but to supply most of the world's wool; also to keep India free from a state of perpetual famine by the great quantities of wheat we send there.

Australia is forging ahead in spite of the natural vicissitudes of bush fires, drought, and the lack of population. We are, however, increasing by over 200,000 a year; half of that number by natural increase and half by immigration, of which half comes from the British Isles because we are a British community and intend to remain so. Over 95 per cent. of our people are descendants of British immigrants, and those men you have seen in the pictures of the out-back are descendants of men who went far afield to develop those parts, partly because of the adventurous spirit which is British and partly because they saw a great undeveloped land that needed their attention. It is fortuitous for us that aviation has come to our aid. It is no boast on the part of Australia but a matter of necessity that there is more aviation *per capita* in Australia than in any country in the world. We have over 70,000 route miles of civil aviation, *i.e.* regular air routes, and there have been up to sixty trips a day between Melbourne and Tasmania. Melbourne has a population of 1¼ million and Sydney 1½ million and half the traffic between is by air. In fact, for the last five years I have travelled something like 400 miles per week going to and from Parliament at Canberra. Aviation and radio have been great aids to us in Australia.

The Flying Doctor has been one of our great benefactors. The idea originated

with an out-back clergyman, the Rev. John Flynn, a Presbyterian who visited desert hostels in the interior and felt that so much could be done for people in the out-back if a doctor could fly to them in response to a system of calls. Now the whole of that out-back region has been covered by circles of safety with a 400 mile radius. Where there are over 500 radio transmitting sets on cattle and sheep stations, neighbours may be 50 or 100 miles apart and the doctor 500 miles away, it is now possible within two hours to have medical attention; and that is something which is not always possible in a large capital city! I was one of those interested in this service. The State of Victoria is too small to need the service but we look after one of the stations in the Kimberleys. Based on Wyndham, with another station at Port Hedland and another at Derby, we were able to serve all that region. It is gratifying to us, and I am sure to you, to know that the Flying Doctor serves equally the native inhabitants, the Aborigines, as well as the white settlers. To the Aborigines the service is absolutely free. It is a private enterprise and from the transmitter stations the operators four times a day send out their messages of medical advice. They all have their call sign, and when it is a medical call the caller is plugged through to doctor or nurse.

On the whole, the Flying Doctor Service has done a great deal for people in Australia, and you have heard on the commercial side what the air fleet project is doing. I have seen the freezing works at Wyndham. The opinion generally held is that all the meat should be dealt with in that way: chilled inland and flown to the coast because then it arrives in better condition than cattle which have had to be driven great distances and are, of course, quite out of condition when they reach the seaboard. It is that beef which normally comes to Great Britain, and it is the beef which you lost in great quantity two or three months ago when over 1,000,000 cattle died because of the vicissitudes of weather and the lack of supplies. The corollary to meat is steel. We need steel for the windmills which now drive the radio sets and for the piping that supplies the material for the artesian bores, because there is water under much of the country. Some of you may have read the book, 'A town like Alice,' by Nevil Shute. Actually Alice Springs was a tiny village a few years ago; now it is almost a city because it has water, and from Alice Springs the settlement is pushing out still further. It is a mistake to believe that if the land were cut up into small lots many more could make a living out of it. The land has to be dealt with in large areas for cattle raising.

As to the Aborigines, sometimes Australia is blamed unjustly. I have only this last week received here in London a letter from an organization, which shall be nameless, wanting to come to me as a deputation because they had read in one of the reputable newspapers that a number of Aborigines had died through witchcraft in Central Australia. I made enquiries and was able to ascertain that death was due to arthritis, pneumonia, measles and a few other diseases not uncommon among white people. Thus I was able to tell these people, in spite of the little tract they sent me dealing with difficulties, that certainly some of the cruelties of fifty and one hundred years ago do not operate now and also I pointed out that it was evident the writer had never heard of the Flying Doctor Service.

The Aborigine is a hunter, and Lord Rennell has said something about him. He is a very happy individual; he is also very indulgent to his children. He is always a hunter, never an agriculturist. As a stockman he is ideal, but he likes to go "walkabout." I know a cattle station west of Alice Springs. The owner, a woman, has 3,000 sq. miles of which she is making a success. She thought the Aborigines working for her should be better clothed and she bought them a

large quantity of plaid shirts, the Cameron tartan. Unfortunately, they have the predilections of the white man and when there is a race meeting they converge upon it. And all those who set out with shirts do not always return with them! It is by no means as easy as some might think to deal with these people. Some are critical of the administration in another continent where there is, unfortunately, trouble just now, but it is as well to realize that it is not possible to bring simple people who have not had the same opportunities as Europeans have had for centuries past, up to the same level in education and civilization in a matter of a few years.

I fear I am on a hobby-horse of mine, and I must conclude. I know how you all appreciate the excellent lecture to which you have listened by one who knows his work, by one who is a great Englishman and a great citizen of the world, and one whom we all like.

Again I say, Lord Rennell, thank you for an extraordinarily fine lecture.

Professor BUCHANAN: It is with a good deal of diffidence that I rise to add my contribution to what you have already heard. Like you, I have immensely enjoyed the description and the comments that Lord Rennell has given in regard to this very little known part of what is, on the whole, perhaps a somewhat little-known continent so far as we in this part of the world are concerned. I am diffident because I have no particular right to be talking to you in connection with an address on the Kimberley district of Australia. I doubt if I have been any closer to that district than the distant parts of Australia which Lord Rennell mentioned; probably the nearest I have been is Singapore. I have, however, a certain amount of practical experience of large-scale livestock rearing (not altogether dissimilar to the cattle stations in the Kimberleys) in the high country of Canterbury and north-west Otago. True, there the animals are all sheep; there are no cattle. The problems are different, but in certain very vital respects they share something of the same difficulties arising from distance, isolation and climate, and they have the same problems in regard to breeding and rearing the right kind of animal for the stations and of disposing of the product in an economic sort of way. Before the war we were accustomed to think of the pampas as a producer of high quality beef from overseas for the British market. We were inclined to dismiss Australia and New Zealand from the beef context somewhat brusquely, by reflecting that, after all, they could not send chilled beef and that any beef once it was frozen lost a great deal of nutritive value; while, further, a good deal of Australia was climatically unsuited to the production of beef of top quality. That was not altogether true, of course, even then, and still less is it true today.

The technical problems of shipping chilled beef from Australia was solved in the early 1930's. But for the war there would have been, no doubt, much greater development of that process than there has been. But since the war the other side of the penny has also changed form a little. We do not any longer get prime chilled beef from the Argentine. I almost venture to guess that as long as we have a Ministry of Food concerned with bulk-buying of all our meat we never will get any more chilled beef from Argentina. After all, if it is necessary to provide for a long period of cold storage in the cumbersome channels through which bulk-bought Ministry of Food meat comes, chilling is entirely out of the question and will possibly be so for a long time still to come. In that respect competition between Argentina on the one hand and Australia on the other is on level terms. Further, the amount of beef we get from Argentina has gone down significantly; it is not merely that the price has gone up but that the quantity has gone down, and the actual physical amount of beef that Australia can produce has become a much more vital matter for their country

and ours than it used to be in those happy pre-war days that some of us can remember.

You have seen, as I have, arising from Lord Rennell's lecture this evening, the vision of possible development in the Kimberleys. Neither Lord Rennell nor, I am sure, the High Commissioner, nor I, would wish to overstress those possibilities. North-west Australia is a country, as Lord Rennell has shown and as the High Commissioner has reminded us, in which the unit will always be a large unit, in which the carrying capacity will always be reckoned in terms of acres to the beast and not of beasts to the acre. It remains true, however, that there are a great many acres, and the sum total of beef-carrying capacity represented in the Kimberley district, leaving out the rest of Australia for the moment, is a very significant total. Given the present post-war conditions, which have added considerably to Australia's competing power, there should be relatively rapid development of the Kimberleys area as compared with what was possible within the limits of financial returns before the war. I am sure, judging from the tone of Lord Rennell's address, that he himself looks forward optimistically to the commercial future of that area, and I am sure you and I who have a developed taste for good beef will wish them every success in the physical returns from their labour.

Mr. T. P. E. REEVE: May I ask Lord Rennell, through you, Mr. President, if he can give statistics, such as price of land in the Kimberley area and the amount of capital needed to start a station? Also what help do the Government of Australia give in that regard?

LORD RENNELL: The price of land it is difficult to give because the land is all leased on pastoral lease for many years at a time. The rent payable to the Crown for the pastoral leases is infinitesmal; it is reckoned in pence per acre. The cost of developing a station is entirely measured by the amount of work and material that one can afford to put into it.

The Glenroy plant dealing with 5000 head of stock cost a little over £20,000 to instal, with all material flown in by air, and it is that, and that alone, which enables an economic output to be got from that and neighbouring stations. I cannot give the return for the current year because the figures are not yet available, but that station is based, as are other killing stations, on a return of 8 per cent. on the capital invested with any further profit which the station may make being returned to the owners of the land as a bonus on meat killed. The price of a similar but slightly larger station today, with improved killing and freezing facilities, might be £50,000 as the cost of dealing with about 7000 head of stock.

The PRESIDENT: I should like to thank Lord Rennell for breaking new ground with an entirely new type of lecture, and a most attractive one. On behalf of all present, Lord Rennell, I thank you.

THE LAPPS: ORIGINS AND AFFINITIES

A. C. ALLISON

THE LAPPS ARE a small group of people, about 33,000 in all, widely scattered over an enormous territory in the northern part of the Fenno-Scandian peninsula. They come under the dominion of four countries: Norway, Sweden, Finland and Russia. To most Lapps this fact has little significance: as a rule they learn to speak, in addition to their own language, the language of the country to which they belong, and they are naturally obliged to obey some at least of its laws. Yet they have remained true to their own old-fashioned way of life, their traditional customs and their picturesque dress. They possess also a keen sense of beauty, which is displayed in the decoration of their household goods and ornaments. It is not surprising that for many centuries they have attracted the interest of travellers and men of science. The contemplation of this people—the least European of Europeans—tending herds of reindeer in the vast forests and frozen wastes of the North, and living a simple nomadic life in tents, has appealed to the romantic emotions which lie in the breasts of even the more sophisticated of us.

In spite of all this attention, little is known of the origin of the Lapps. The documentary evidence concerning their history is scarce and unreliable up to the seventeenth century, and the archaeological discoveries so far reported cannot tell us much about their prehistory. The language of the Lapps is interesting because it offers a clue to their past and present-day relatives; but deductions of this sort must be made of course only with great caution, since languages can easily be taken over and assimilated by certain peoples from others who are racially different. It should at once be made clear that the word "race" means to me, simply, a group of human beings who have in the course of time become differentiated sufficiently from other groups to be distinguishable from them by objective criteria. No invidious implication of the racial superiority of any one group is intended.

Lapp is not an isolated tongue like that spoken by the Basques, for instance. It is a Finno-Ugrian language, most like Finnish but similar also to the Samoyed languages which are spoken along the Arctic coast of European Russia and in Western Siberia. Unfortunately, the philologists cannot agree on the relationship of these tongues, and I shall mention only two of the schools of thought. Some assume that about two thousand years ago the Lapps adopted the language of the proto-Finns; others have suggested the exact opposite, that the common ancestors of the Finns and the central Uralic peoples of Russia (Mordvins, Cheremiss, Permians) at some remote period in the past changed their vernacular—perhaps an Indo-European tongue—for the Finno-Ugrian language of the forefathers of the Lapps. If the latter theory be true, then the Lapps, together with the Ugrians (Magyars of Hungary and the small groups of Voguls and Ostyaks near the Gulf of Ob in North Russia) and the Samoyeds must be the descendants of the people who spoke the common Uralic parent language.

In deciding which of the two alternatives is the more likely to be correct, the only line of investigation left open to us is physical anthropology. If we can determine how closely these different peoples are related to one another and to other European populations we are already a long way towards solving the problem. This sort of inquiry, however, is not without its pitfalls. In the first place, we are dealing with contemporary groups, which may well have changed considerably in the course of time through the introduction of extraneous elements. It is also true that the methods of assessing racial relationships at our disposal are still rather poorly developed. We must avoid

being misled by the results wherever alternative explanations fit the facts equally well.

The most promising method which has recently been widely applied to race biology is the study of blood groups. An extensive range of antisera is now available for anthropological work and, since the genetics of the blood groups are known, a whole series of blood group gene frequencies can be calculated in any given population. The incidence of some other simply genetically determined traits can also be ascertained. Having done this, we can compare the gene frequencies in different peoples (making allowance for the selective elimination of certain genes) and we are then in a position to assess in an entirely objective way their similarities or differences. Studies on other races have shown that this is a valuable tool in the hands of careful observers. By its application the earlier findings of anthropologists who

relied on physical measurements, skin and hair characters and so forth have been greatly extended.

With these problems in mind, I have spent two summer vacations doing field work in Lapland and applying the techniques of genetical anthropology to the Lapp population in different areas. The results of these investigations are reasonably clear-cut, which is unusual and satisfying in a field of inquiry so general as race biology. It is evident that the Lapps form a distinct racial group, which is comparatively homogeneous within itself and unlike any other people in Europe, including their Scandinavian neighbours. It is especially significant that the Lapps are sharply differentiated from the Finns. The Lapps have for instance a very high incidence of the A_2 gene, a low frequency of the d or Rhesus-negative gene, and a comparatively high incidence of the chromosome combinations cDE and NS. There is no doubt that some intermarriage between the Lapps on the one hand and the Finns and Scandinavians on the other has been constantly taking place for centuries. This would tend to obliterate the genetical differences between them, particularly in so small a group numerically as the Lapps. Hence we are safe in assuming that in their original stock the Lapps differed even more greatly from the Scandinavians and Finns than they do now.

When the available information concerning the Finns is examined, we find another state of affairs altogether. The differences in blood group combinations from their neighbours in Sweden and Germany are comparatively small, and other characteristics show the same trend. It is possible, therefore, to draw the general conclusion from the study of known genetical factors that the Finns and the Western Europeans are cousins while the Lapps are, at the most, distant relatives. It follows that, since some language shift must be postulated, the second of the two alternatives mentioned above is the more likely to be correct, *i.e.* that the Finns and closely related groups (Esthonians, Karelians and Uralic Russians) are the descendants of an originally Indo-European speaking people who took over their Uralic tongue from some other group, probably the common forefathers of the Lapps, Ugrians and Samoyeds. No more than this can be concluded at present. It would be of great interest to have comparable data from the Samoyeds and Ugrians, but it seems that this type of work is not encouraged in Russia, where Mendelian genetics is a heterodox discipline. The only Ugrian people who have been investigated at all are the Magyars of Hungary. However, centuries ago the Magyars themselves formed only a small ruling minority in a large community of Turkish origin, and, although their Finno-Ugric language has remained, in the modern Hungarian population the original Magyar stock has been so diluted by intermarriage with other individuals that comparisons between them and the Lapps are not very instructive.

We can assume, then, that the Lapps are a Uralic people who have been living in Northern Scandinavia for two or three thousand years, or perhaps even longer. In the course of time they have differentiated into groups speaking three distinct tongues. These varieties of Lappish—Northern, Central and Southern—are sufficiently different from one another to be regarded as separate languages rather than dialects; they are spoken side-by-side in the intermediate zones by individuals who are consciously bilingual. Of course,

this linguistic divergence does not necessarily indicate the existence of a corresponding change in the peoples themselves. We have here the ideal conditions for rapid evolution of a language: a large measure of geographical and cultural isolation, and an oral language which has only recently (during the past 250 years) been written.

There is good reason, however, for separating the Northern group from the rest. This group comprises the Skolt Lapps recently evacuated from the Petsamo district and now living in the Lake Inari region of Northern Finland, the Russian Lapps of the Kola peninsula, and fisher communities scattered along the Arctic coast of Scandinavia. These people have certain characteristics in common which differ significantly from those of the other Lapps: they have distinctive blood groups and head measurements and, among them, features which we have come to regard as Oriental—yellow skins, slant eyes and high cheek bones—are relatively common. The rest of the Lapps, who speak the Central and Southern languages, seem to form a single racial unit. They are for the most part reindeer breeders who live as nomads or as settled communities in Norway, Sweden and Finland.

In the beginning it is likely that the Lapps were food gatherers subsisting on fishing and hunting and the vegetables of forest and marshland. Early reports substantiate this view: Tacitus, in his ethnographic treatise 'Germania' wrote of the Fenne (whom we can very probably identify as Lapps) that they were hunters, quite uncivilized and terribly poor, having no weapons other than arrows with points of bone, eating herbs, dressed in furs and sleeping on the earth. Later the Lapps began to tame and eat reindeer and, because of this, eventually their way of life changed completely. In glacial times reindeer roamed over a large part of central Europe as far south as the Pyrenees, to judge from remains which have since been recovered. Nowadays wild reindeer are found only in a few small pockets in Norway. How and where reindeer breeding began is unknown. Some authorities have supposed that at first single reindeer were captured, broken in and used as draught animals. Others have suggested that the domestication of reindeer might have succeeded a kind of game protection. If the deer had become scarce in any one region, it is natural that the Lapp hunters would have accompanied them in their autumnal migrations. Slowly the animals might have become accustomed to the continued presence of the Lapps who would, incidentally, help to protect them from other hunters and from marauding wild beasts. Eventually a situation very similar to the so-called "open system" of reindeer breeding might have developed. This system is widespread to-day: the reindeer are half wild, although each one is the private property of an individual and earmarked accordingly. When the reindeer follow their natural bent to collect together and move to another district in the spring and autumn, the Lapp families are obliged to pack up their tents and belongings and set off in pursuit. This wide periodic migration is known as full nomadism, in contradistinction to the half nomadism, or lesser migration, which still takes place in parts of Lapland. In the "open system" of reindeer breeding only a few of the reindeer are tamed and used as draught animals—they are never ridden by adults. Goats are kept for milking and cheese-making. The "closed system" of reindeer breeding, in which a relatively small number of animals

are kept and milked regularly, may have been a later development; it is disliked and is dying out to-day.

In their reindeer herding the Lapps are greatly assisted by dogs—a variety of the Spitz breed, well trained and intelligent. Some reindeer-breeding tribes in Siberia do not have dogs, but the extended breeding practised by the Lapps would be practically impossible without them. The Lapps are very fond of their dogs, and many of their folk stories illustrate the devotion and help which dogs can render to man. Indeed, one of the most certain ways of gaining the confidence of a Lapp, which is by no means easy at any time, is to discuss dogs or reindeer with him; his natural suspicion melts away, his eyes light up and his conversation becomes animated.

To-day most Lapps still live on reindeer and the sale of reindeer meat and skins, which fetch good prices on the open market. Their diet includes more bought foods than it did in former times. Pine and birch products have been replaced by flour, and such luxuries as coffee, sugar and tobacco are used extravagantly. Other Lapps work in the forests or subsist on fishing. For the most part the Lapps are left alone with the minimum of interference, and they are happy and contented with their lot. They learn the fundamentals of language in the nomad schools, so that literacy is spreading. Opportunities for advancement are not denied them; some have had a secondary school education and a small number have passed through the Universities. One is a respected member of the Norwegian *storting* or Parliament; another is an able ethnologist studying his own people from Uppsala; a few others are known internationally as writers and artists. And it must not be forgotten that ski-ing was a commonplace in Lapland long before it spread to the rest of Europe. Thus the Lapps have in their own way influenced the civilization of Western Europe.

At present, then, the Lapps are holding their own. What will happen to them in the future? This question raises the more general problem concerning the capability of survival of small, isolated communities anywhere in the world. Some have supposed that the Lapp race will gradually die out, partly through progressive admixture with their Scandinavian neighbours and partly through the natural decline in vigour which tends to overcome small, inbred groups. Signs of such a decline are, in fact, evident to-day. The Lapps are not increasing appreciably in number and their population is ageing. Their infertility is remarkable; they practise no methods of birth control, and most of them are fond of children and anxious to have large families. Naturally, the infant mortality is high because of the hazards of living unprotected in so severe a climate and the absence of good medical attention. But this is not the whole explanation; nor can the relative infertility of the Lapps be attributed to any prevalent disease or to their diet which is, in general, adequate and sufficiently varied. A possible explanation seems to be their continued inbreeding. It is inevitable that this should have occurred in so small and widely scattered a population, and its ill-effects on the Lapps can readily be seen in the unusually high incidence among them of certain physical abnormalities such as congenital dislocation of the hip and colour blindness. Curiously enough, the continued inbreeding does not seem to have affected their physical strength adversely. The Lapps are still hardy and vigorous and

they are capable of great feats of endurance on foot and ski. In general, we can conclude that the Lapps will continue to live as they have done, for several generations to come; their ultimate future will remain obscure until we know more of the biological factors affecting human development.

The administrative position in Lapland naturally differs in many particulars from that obtaining in relatively undeveloped territories in the British Commonwealth. The treatment which has been accorded to the Lapps by the Scandinavian governments has been, on the whole, successful. The Lapps are left free, apart from obligations to attend school and do military service, and from occasional brushes with Scandinavian farmers. The governments have been sufficiently enlightened to resist attempts to cut down expenditure on teaching and administration in Lapland. Race prejudice and discrimination is not a serious problem. We have indeed something to learn from the Scandinavians in respect of their wise tolerance of a people with traditions quite different from their own.

THE FILLING AND DRYING OF LAKE EYRE

C. WARREN BONYTHON AND B. MASON

WATERS POURING DOWN the courses of long-dry rivers reached Lake Eyre in June 1949, and began spreading over the saline flats that comprise the lake bed. During this and the ensuing year such a volume of water was to flow that the whole of the 3000 square miles area of Lake Eyre North was finally to be submerged. The flooding was only a transient phenomenon however, for by the beginning of 1953 the lake was dry once more. Although there is little doubt that it has been flooded to a greater or lesser extent more than once during the past century, this is the only time that a great flooding has been demonstrated conclusively.

The 1949–50 flooding

The events leading up to the 1949–50 flooding were apparent to the general public. Phenomenally heavy rains fell in northern and eastern Australia, and many of the inland rivers came down in flood, inundating vast areas of plain, flooding homesteads and even isolating whole communities. These abnormal conditions were associated with a definite break in the normal sequence of atmospheric pressure changes over Australia. Usually the paths of the centres of the migratory anticyclones lie to the south of the continent during the summer months, but during these two years their summer trajectory was more like the normal winter one. A parallel effect to the rains was the occurrence of droughts, or near-droughts, in the southern states.

Lake Eyre is at the focus of a great drainage basin half a million square miles in area (see Fig. 1). Its rivers, dry channels most of the time, converge from all directions, but the chief ones come from the north-east, in Queensland, where in one place the watershed is 700 miles distant from the lake. In central Queensland the Thomson and Barcoo rivers join: from their confluence down to the lake the stream is known as the Cooper (or Cooper's Creek). The Diamantina river flows from western Queensland to South Australia, there to be joined by a large river system originating in the north. This consists of the Burke, Hamilton and Mulligan rivers and also the Georgina, the combined stream being called Eyre Creek. The Diamantina and Eyre Creek meet in South Australia at the great swamp of Goyder's Lagoon, and emerge as the Warburton which flows into the northern end of Lake Eyre. In the last stages of its journey to the lake the pattern of this stream becomes most complicated, for one overflow channel, the Kallakoopah, breaks away only to rejoin it where it debouches into the lake, while another, the Kalaweerina Creek, leaves it rather nearer the lake which it then enters independently. The Warburton at its mouth is joined also by the Macumba. The Macumba is fed from the north-west by the Alberga, and also theoretically by the Finke which starts in the Macdonnell Ranges of the Northern Territory, but it is very seldom that Finke floods carry right through to the

Macumba. The Neales, draining the country round Oodnadatta, flows into Lake Eyre's north-west corner, while numerous minor streams come in on the western side. Finally, in the south-east the Frome, having its source in the Flinders Range, is joined by the smaller Clayton as it enters the lake.

The first really significant fall of rain occurred when a tropical cyclone crossed the Queensland coast in February 1949, and deluged the interior catchment areas. Stations in south-western Queensland recorded 200 to 400

Figure 1

points.[1] These falls served to moisten the "Channel Country" [2]—the remarkable flood plains of the inland rivers.

While little rain fell in the first months that followed, the rivers continued to flow strongly: the Cooper swept steadily on, filling swamps, lagoons and small lakes until in June 1949 it breached the dams of drifted sand built up in the past three decades near Kopperamanna in South Australia and entered Lake Eyre. Further significant rains fell in September and November, making rivers rise again rapidly. Then January and February 1950 saw good rains over the headwaters of the Thomson, the Barcoo and the Diamantina, while

[1] 100 points = 1 inch.

[2] Bureau of Investigation, Queensland, 'Tech. Bull. No. 1' (1947).

Table 1

District Average Rainfall in 1949–50. (Rainfall in points.)

District	*Year*	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*
36 ..	1949	264	393	538	33	5	20	0	0	68	573	101	146
37 ..	1949	144	316	596	2	1	0	0	0	10	169	69	337
38 ..	1949	116	214	604	6	30	7	0	0	80	464	37	82
45 ..	1949	79	315	1258	39	77	80	7	0	243	549	99	12
17 ..	1949	3	170	121	6	115	18	44	7	112	113	28	11
36 ..	1950	459	705	851	594	273	160	477	14	69	244	650	182
37 ..	1950	471	504	825	112	94	201	91	0	52	109	272	437
38 ..	1950	237	182	1527	81	162	149	104	2	92	271	330	375
45 ..	1950	336	103	712	250	122	136	205	3	129	387	392	114
17 ..	1950	1	368	384	0	166	93	18	5	5	94	155	114
Cordillo	1949	2	692	703	0	29	0	0	0	86	123	29	0
Downs	1950	Not available											
Clifton	1949	105	510	1406	19	20	0	25	0	26	0	0	0
Hills ..	1950	Not available											

Table 2

Some Rainfall for Individual Stations. (Rainfall in points.)

	1890	*1891*	*1906*	*1907*	*1916*	*1917*	*1918*	*1920*	*1921*	*1949*	*1950*
Boulia	1847	1401	1394	1050	2290	2261	846	2538	1633	1298	3143
Winton	2774	2765	2522	959	2727	3037	2061	2935	2179	2339	4177
Longreach	—	—	3262	1933	1971	2882	2048	1837	2241	2362	4134
Isisford	4142	4705	3596	1299	2188	2221	2426	2752	2289	2473	5154
Windorah	—	2161	—	—	2029	1757	1476	2224	1837	2186	3898
Cordillo Downs	1599	870	839	1142	1164	663	627	1489	683	1664	—
Clifton Hills	—	—	—	—	—	—	—	—	—	2111	—

three cyclones in March produced extremely heavy gauge readings. Windorah (normal annual rainfall 1005 points) had 1962 points in the single month, while Urandangie (normal annual rainfall 964 points) had 1473 points in the month.

Heavy rains had fallen in other parts of the interior, including the vicinity of Lake Eyre itself. For instance, at Marree, where the mean annual rainfall is 561 points, a total of 1608 points fell in 1950. In this year the north-western streams came down in flood, and the Frome in the south-east flowed into Lake Eyre for six weeks.

The rainfall for 1949 and 1950 has been summarized in Table 1, where "district averages" for districts 36, 37, 38 and 45 in Queensland and district 17 in South Australia are shown. Because of the unrepresentative distribution of stations in District 17 the data for Cordillo Downs and Clifton Hills have been included.

The filling of the lake

A plane chartered by the Royal Geographical Society of Australasia, South Australian Branch, flew over the lake in November 1949, to observe and photograph the extent of the flooding. The airmen were able to report that water covered about 1000 square miles in the southern part of Lake Eyre North. Much water must have flowed in during the next six months for, in spite of the considerable evaporation losses of a summer season, the R.A.A.F. Photographic Unit found nearly all of Lake Eyre North covered on 11 May 1950. The lake reached its highest level at the end of September 1950. E. Bonython has briefly described it at this stage.[1]

Lake Eyre North was "full" during the latter half of 1950. We may define the lake as being full when the whole of the area of this great salt pan—which has quite a well defined shoreline—is covered with water. It is clear that the degree of fullness in terms of water level could have had no significance to us prior to 1949–50. A maximum depth of 12–13 feet in the south-eastern bay was measured by boat parties. Since the floor shelves upwards towards the north end the average depth in the lake was less, perhaps 7 feet. Lake Eyre South, the 400-square mile salt pan immediately south of the main lake, remained almost dry during this period. A narrow channel or "neck" joins the two, but the level in the north one did not rise high enough for water to flow through southwards. However, a tongue of water reached some miles down it.

The surrounding country was transformed by the heavy local rains. In the winter of 1950 the desert veritably bloomed: sandhill and clayflat were bright with wildflowers of all colours, and long grasses waved. Some said that the whole climate of the Centre was transformed by the lake, and recalled past plans for diverting coastal rivers into the Lake Eyre Basin and for cutting a great canal from the sea to flood this below-sea-level region. However, the transformed climate was confined to the lake itself and a margin a mile or so wide round its shores, and subsequent events strikingly disproved the theory of a changed climate, for the surrounding lands were to suffer a drought even while the lake evaporated fast into the dry continental air.

[1] Bonython, E., *Walkabout* (Aust. Geogr. Mag.), Nov. 1950.

The flooded Channel Country, April 1949
Photo: Royal Australian Air Force

Muddy flood waters beside the Shore of Lake Eyre north

Kalaweerina Creek flowing into Lake Eyre, October 1950

Possible floodings of the past

Our knowledge of the early days of the exploration of Lake Eyre has been adequately summarized by Gregory [1] and Madigan.[2] The first explorers, including Sturt, believed—without positive evidence—that there might be a great inland sea in the interior of the continent. E. J. Eyre—after whom the lake was named—found water in an arm of Lake Eyre South in 1840, but he did not go on to find Lake Eyre North. Much water reached Lake Eyre in the early 1890's, but there is no positive record of its actually being in the lake. It is not until 1922 that a positive report is available.[3] A geographer, G. H. Halligan, was flown along the south and west shores in a Royal Australian Air Force plane, on probably the first flight made in that region. He reported that the lake was one third filled, and he showed the distribution of the water cover in a map. His attempt to estimate the water depth by analogy between its colour and that of sea water in Spencer Gulf gave figures which must now be concluded too high. His delineation of the area agrees in general, but not in detail, with what would be expected from present knowledge if the lake were one third covered. Madigan [2,4] found a dry lake in 1929. He is probably the most discerning observer to have visited the lake, but since he saw it after years of drought this no doubt influenced his views about its ever filling with water. He did not believe that it could fill completely. He used arguments based on the average rainfall of the catchment areas and an assumed run-off fraction. His conclusion on this basis that Lake Eyre could not hold *permanent* water is probably sound, but his use of the same figures to show that it could not fill at all was a mistake, for it was not an average rain that filled the lake in 1949–50 but a decidedly abnormal one. His statement that "the rivers never run all at the same time" was also wrong, for they all ran in 1950. Madigan contributed some very useful information on the dry lake bed.

Only sketchy rain records are available for before 1887, and another difficulty is that monthly district rainfall averages, as used in the 1949–50 analysis, cannot be computed for before 1913. To enable comparisons to be made with past years individual station records have been used. A study of the data suggests that years when water possibly flowed into the lake were 1890–1 1906–7, 1916–7, 1917–8 and 1920–1, so these were compared with 1949–50. Table 2 sets out the data in the form of total annual rainfalls. Of the periods chosen, 1890–1 seems the one most likely to flood Lake Eyre because rainfall in the Queensland districts was of the same order as in 1949–50 and opportune rains fell at the same time in the lower Channel Country. Over the period covered by the rainfall records of Table 2 we can only feel confident that Lake Eyre was "full" twice—*i.e.* after 1890–1 and 1949–50. Hence, if this separation is typical, the lake can be said to fill perhaps twice a century.

The evaporation rate

Late in 1950 the Royal Geographical Society of Australasia, South Australian Branch, appointed a committee under the chairmanship of Dr. A. Grenfell

[1] Gregory, J. W., "The Dead Heart of Australia," 1906 London, John Murray.
[2] Madigan, C. T., *Geogr. J.* 76 (1930) 215.
[3] Halligan, G. H., *Report Aust. Assoc. Adv. Sci.*, 16 (1923) 120.
[4] Madigan, C. T., "Central Australia," 1944 Oxford Univ. Press.

Price to report [1] on the flooding of Lake Eyre. The authors of this paper were two of the members who had to report on the evaporation rate and the rainfall respectively.

C. W. Bonython in dealing with the evaporation problem, realized that he could not base his report entirely on existing meteorological records, but that he must take practical measurements at the Lake itself. For years the evaporation rate for the area had been quoted as 100 or even 120 inches per annum. These figures were based on maps prepared from the records of tank evaporimeters—small tanks of fresh water sunk in the ground—but it is well known that the evaporation rate so derived is not the same as would occur from an extensive area of water surface. Here the real rate would be lower. This is partly because the introduction of a large lake into a dry, continental interior will modify the climate of the air over it. Humidity and air temperature, and even wind and solar radiation will be affected, in that order. Another difference is in the atmospheric turbulence just above the water surface of the evaporimeter and of the lake. Furthermore, evaporation rate decreases with increasing salinity, and Lake Eyre was as salt as the sea to start with, to become a saturated brine in the later stages of drying-up. It seemed desirable to arrive at a definite measure of the real evaporation rate.

There were two methods of attacking the problem:

(*a*) To measure the actual fall in lake level as it dried up.
(*b*) To observe the modified meteorological conditions over the lake itself and to use the data in an expression of the physical theory of natural evaporation.

It was the end of 1950 before such a programme of work was decided upon. By then the rivers had practically ceased flowing and the high evaporation of summer was lowering the lake level. How much water was being lost by seepage downwards was unknown. It was considered small, as the lake is in an enclosed basin below sea level, and is underlain by an age-old accumulation of impervious clay deposits extending over an area greater than that of the present lake. Theoretically, in fact, any leakage should be upwards, not downwards, as suggested by the existence of "mound springs" (vide Madigan) in the lake floor: these permit a small quantity of water to leak upwards to the surface from the aquifer of the Great Artesian Basin deep underneath. By the end of 1950 the lake bed should have become fully saturated with water, so the observed change of lake level could be considered practically a direct measure of evaporation.

The first project was to fix a graduated level gauge post in the water near the shore and to watch further fall in level. The second was to take measurements of solar radiation, air and water temperatures, humidity and wind over the lake. Two short expeditions for 1951 were planned, one in the winter and the other in the summer. On each occasion it was proposed to establish a temporary weather station on a convenient part of the lake shore, there to continue observations for seven days. It was hoped that the results could be correlated with the records of certain permanent weather stations 50–100 miles away so that a picture of the meteorological conditions over the lake

[1] A detailed report will probably be published during 1953.

for the whole year could be constructed. It is true that the information so obtained might not be very accurate, but it would be better than none at all. The expeditions were made in May and December, 1951 : descriptions of them have appeared elsewhere.[1,2]

To arrive at an estimate of the evaporation, the calendar year of 1951 was considered, when river inflow to Lake Eyre was negligible, and the rainfall was approximately four inches. Seepage has been neglected. The exposed water area shrank as the year progressed, but this should not affect evaporation treated on the basis of depth evaporated per unit time: the fall in lake level and evaporation should be the same thing.

However, in the later stages of drying-up the lake waters surging about due to seiches probably wetted a rather greater area than that of the water surface at the time, but the effect was probably not great and no attempt has been made to allow for it. Seiches had been noticed by visitors in 1950, and they were measured during the May and December expeditions of 1951. They seemed definitely to be associated with wind. The oscillations were more sudden and rapid in December than in May, and this could be explained not only by the stronger winds of December but by the fact, that since the water body in December was small and shallower, it would have a shorter period of oscillation and it would respond more rapidly to the wind. The total range of movement observed in December was 2·7 feet, but there was also a period of three days when the lake was relatively quiescent, and this enabled the mean level to be determined. Single readings of the lake's level hence may be liable to error, but the mean values for the May and December periods should be reliable.

Lake level is plotted against time in Fig. 2. "Reduced Level" refers to a datum 100 feet below the zero of the May 1951 gauge post. Since the curve for the annual march of evaporation from an open water surface is usually nearly a pure sine curve the time scale has been constructed on this basis so as to give approximately a straight line relationship. The fall in level for the calendar year of 1951 is seen to have been 7·5 feet, or 90 inches. Allowing for rainfall the evaporation rate based on these measurements becomes 94 inches.

Records of the meteorological elements of total insolation, hours of bright sunshine, air temperature, humidity and wind speed over the lake, as well as water temperature and salinity, were made during the two observational periods. The records of permanent weather stations in the surrounding area were used for comparison, so that the year's conditions over the lake might be estimated by interpolation. Use was made of air temperature and humidity at Oodnadatta and Marree, hours of bright sunshine at Oodnadatta and Woomera, and wind speed at Oodnadatta. The mean monthly values believed to apply over Lake Eyre were worked out. From these were derived nett gain by the water of radiant energy, and the transfer coefficient for the air layer over the water. By applying the Ferguson Equation [3] for natural evaporation, introducing corrections for the vapour pressure of the saline water, C. W.

[1] Bonython, C. W., *Weather*, 6 (Oct. 1950) 310.
[2] Peake-Jones, K., *Walkabout* (Aust. Geogr. Mag.), Apr. 1952.
[3] Ferguson, J., *Aust. J. Sci. Res.* "A" 5 (2) (1952) 315.

Bonython calculated the evaporation rate month by month. A total of approximately 80 inches was found for 1951.

H. L. Penman, using his well-known method [1] (which is fundamentally the same as the Ferguson Equation), calculated the lake evaporation rate for the short May and December observational periods, and then constructed the evaporation curve for the rest of the year by correlating them with the readings of a small tank evaporimeter at Yudnapinna, 200 miles to the South. He obtained a figure of approximately 90 inches for 1951.

Things had to be stretched far to arrive at these calculated results which hence must be considered liable to an error of 10 per cent or more. From the

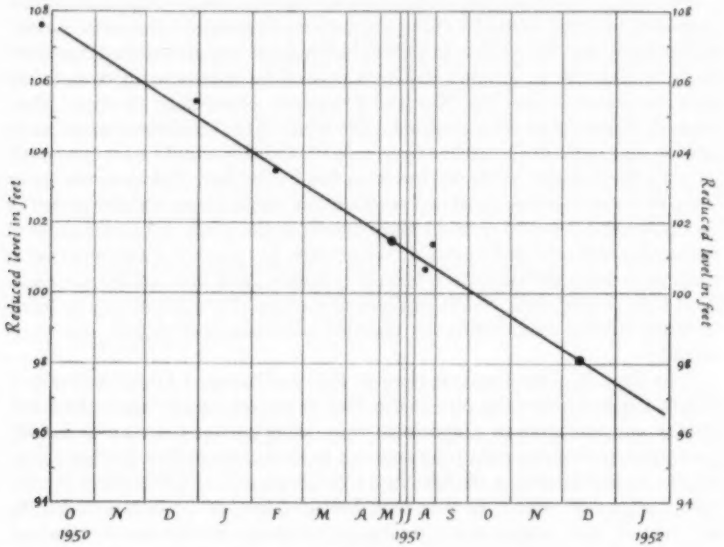


Figure 2

fact that these and the value from lake level change fall within the range 80–95 inches per annum, it may be concluded that the real evaporation rate of Lake Eyre under the conditions following its filling is somewhat less, but not much less, than the once-quoted 100 inches per annum. However, it should be recognized that the first part of 1951 was exceptionally hot and dry, and evaporation for this year may well have been above normal.

Volume and salinity

The level measurements shown in Fig. 2, together with rough estimates of surface water area (see Fig. 3), make an estimate of the water volume in Lake Eyre possible for the first time. The volume held at the height of the flooding was found to be approximately 13 million acre-feet. According to these

[1] Penman, H. L., *Proc. Roy. Soc.* "A" 193 (1948) 120.

calculations the volume had fallen to 9 million acre-feet by the end of 1950, to 4 million acre-feet by May 1951, and to 1 million acre-feet by December 1951. There must have been a total evaporation loss during the 1949–50 summer of about 10 million acre-feet, so it is likely that over 20 million acre-feet of water had flowed into Lake Eyre during 1949–50.

Five analyses were made of water sampled between October 1950 and December 1951. Madigan's finding that there were only small amounts of salts other than sodium chloride in Lake Eyre has been confirmed. The proportions of the dissolved constituents to one another were more or less

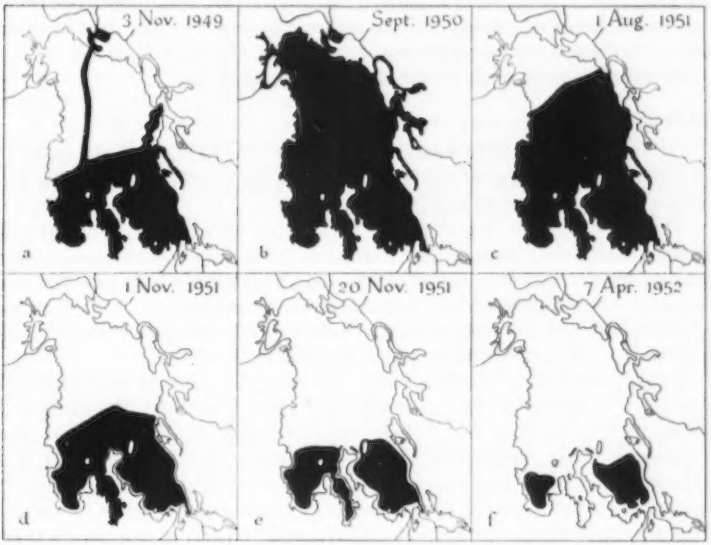


Figure 3

constant in the analyses, and the average composition of the dissolved solids is as follows:

Sodium chloride	.. ..	96·14 per cent.
Potassium chloride	.. ..	0·02 ,,
Magnesium chloride	.. ..	0·45 ,,
Magnesium sulphate	.. ..	1·01 ,,
Calcium sulphate	.. ..	2·38 ,,

Salinity ranged from 38·5 gm./kg. in October 1950, to 209 gm./kg. in December 1951.

If it is assumed that the water samples analysed were truly representative of the whole lake, then the tonnage of salt in solution may be calculated from the volume and salinity figures: the values varied between 300 and 600 million tons. We can conclude that Lake Eyre contains an amount of salt of the

general order of 500 million tons. Practically all the salt is likely to be found in two comparatively small areas in the south-east and south-west. When Madigan walked out on to the massive salt crust in 1929 he probably reached the lowest part of the lake bed and stood on the thickest part of the crust. (The point that he reached was near the centre of the south-eastern bay.) Observers from the air on 7 April 1952 discerned a white area immediately outside the edge of the water which was, in fact, the perimeter of the reforming salt crust. Also of interest was the previously unsuspected shoal which was seen, nearly encircled by the waters. This bears out an observation made by Madigan: he referred to crossing a narrow, salt-free area some three miles out on his salt crust journey, and he was a little puzzled by it. It seems that his track crossed the northern tip of this shoal which, as C. W. Bonython since found in 1953, is above the level of salt deposition.

Subsequent events

C. W. Bonython saw the lake from the air on 7 April 1952, when two areas of water remained—one of 270 square miles in the south-east and one of 120 square miles in the south-west (see Fig. 3, f).

The next available report stated that on 10 October 1952, an area of approximately 150 square miles of water was left in the south-east, while there was practically nothing in the south-west. This clearly suggests that the lowest portion of the lake bed is in the south-eastern bay.

The whole lake was reported dry in January, 1953: thus the cycle of filling and drying had occupied three and a half years.

On the basis of previous ideas a long waterless period should have followed: however, in February 1953 a small flood came down the Macumba and Neales rivers, covering the south-western bay, while in April 1953, a quite considerable one, originating at the headwaters of the Diamantina and Georgina, covered a large part of Lake Eyre North—temporarily, at least. It is evident that our ideas as to the frequency of minor floods must be revised in the light of these recent events. The regular reports now available from aircraft are providing the data which are changing our outlook. While floods down the Cooper are known to be rare this is not so with the Diamantina–Warburton system which carries water every few years. Water from the latter probably lodges in the south-western bay of Lake Eyre North before evaporating. Now we may surmise that many of the old reports of water in parts of Lake Eyre, so readily dismissed as being the effects of mirage, were true after all.

Our thanks are due to members of both evaporation expeditions; to Eric Bonython; to E. Price; to Trans-Australia Airlines for furnishing reports on the state of the lake; to the Commonwealth Meteorological Branch for the loan of instruments; and to I.C.I. Alkali (Australia) Pty. Ltd. for the loan of instruments and for granting C. W. Bonython additional leave.

The authors also wish to thank Air Vice-Marshal V. E. Hancock and W. H. R. Nimmo for help in obtaining the photograph facing p. 324.

THE DISTRIBUTION OF THE WELSH LANGUAGE, 1931–1951

D. TREVOR WILLIAMS

THE PUBLICATION of Table XI.1. of the one per cent. sample tables of the 1951 Census of Great Britain[1] makes it possible for a broad assessment to be made of the position that the Welsh language holds in the Principality today as compared with twenty years ago, a period of considerable permanent migration of population from Wales and of temporary movement into Wales during the war years 1939–45. The Census, unfortunately, gives no information on the numbers of Welsh speakers domiciled in England and Scotland.

In studying the Table the limitations of the one per cent. sample, particularly in regard to the liability of increasing percentage error with decreasing numbers in the sample items,[2] must be borne in mind but from it the general trends of linguistic change can be recognized on a county basis. It is a matter of congratulation that this can be done some years ahead of the publication of the full census returns.

In a previous contribution[3] I dealt with the distribution of the Welsh language according to the figures of the 1931 Census. In that year, four out of every five persons aged three years and over in Anglesey, Caernarvonshire, Merioneth, Cardiganshire and Carmarthenshire were able to speak Welsh. Bordering this heartland of Welsh-speaking Wales were the counties of Flint, Denbigh, Montgomery, Brecon, Glamorgan and Pembroke in which three to five in every ten of the population were Welsh-speaking. In Monmouthshire and Radnorshire about one in twenty said that they could speak the Welsh language. From the parish figures it was possible to recognize those parts of the transition counties in speech which had a high percentage of people able to speak Welsh (usually they bordered the Welsh-speaking counties of the West) and those parts where relatively few had a knowledge of the language. In Pembrokeshire the linguistic divide, "the Landsker," was sharply defined, and this is also true of much of Flintshire, Denbighshire and Montgomeryshire. In Glamorgan a belt of linguistic instability was demarcated extending south-west to north-east from Neath and Port Talbot to Merthyr Tydfil and Pontypridd, and including the mid-Glamorgan valleys north of Bridgend and the Rhondda, Cynon and Taff valleys in the north-east of the county.

The figures of the 1931 Census and of the 1951 one per cent. sample have been set out comparatively in Table 1 in order to show the respective percentages of Welsh-speaking persons in the populations (aged three years and over) of each county and to bring out the percentage decreases during the past

[1] H.M. Stationery Office, London, 1952. Part 2.

[2] *Ibid.* Introduction and general explanatory notes, pp. i–xix, and particularly pp. vii–viii. "In a sample item in the neighbourhood of 2,500 the chances are 2 to 1 that the error is plus or minus 50 (*i.e.* 2 per cent.) and 20 to 1 that it is less than plus or minus 100 (*i.e.* 4 per cent.); for a sample item near 200 the chance is about 2 to 1 that the error is somewhere between 0 and 7 per cent. For validity tests generally, the percentage error will usually be of more significance than the actual amount of the error."

[3] "A linguistic map of Wales according to the 1931 Census, with some observations on its historical and geographical setting." *Geogr. J.* 89 (1937) 146–51.

Table 1

County	*Population Age 3 years and over*		*Able to speak Welsh*				*Percentage decrease of persons able to speak Welsh*
	1931	1951	*Census 1931*		*One per cent. sample* 1951		1931–51
	Census	*One per cent. sample*	*Number*	*Percentage*	*Number*	*Percentage*	
Monmouth	413,191	400,700	24,963	6·0	10,700	2·7	3·3
Glamorgan	1,166,998	1,144,100	355,373	30·5	225,700	19·7	10·8
Carmarthen	171,445	164,800	141,138	82·3	124,000	75·2	7·1
Pembroke	83,274	85,600	25,477	30·6	26,100	30·5	0·1
Cardigan	53,186	52,100	46,291	87·1	41,400	79·5	7·6
Brecon	55,153	54,000	20,547	37·3	16,800	31·1	6·2
Radnor	20,362	19,000	974	4·8	600	3·2	1·6
Montgomery	46,267	43,400	18,845	40·7	15,400	35·5	5·2
Denbigh	150,656	161,500	73,092	48·5	58,900	36·5	12·0
Flint	107,581	137,700	34,076	31·7	30,100	21·9	9·8
Caernarvon	116,013	119,600	91,897	79·2	83,500	69·8	9·4
Merioneth	41,311	39,500	35,544	86·0	30,000	75·9	10·1
Anglesey	46,940	49,100	41,044	87·4	39,100	79·6	7·8
Total. Wales ..	2,472,377	2,471,100	909,261	36·7	702,300	29·3	7·4

two decades. In Table 2 the percentage change of population and of those able to speak Welsh between 1931 and 1951 is given for each county, taking the 1931 figures as 100.

Table 2

County	*Persons able to speak Welsh* *Percentage change 1931–51* 1931 = 100	*Population* *Percentage change 1931–51* *Age 3 years and over*
Pembroke	+ 2·3	+ 2·8
Anglesey	− 4·8	+ 4·6
Caernarvon	− 9·1	+ 3·1
Cardigan	−10·6	− 2·0
Flint	−11·7	+28·0
Carmarthen	−12·0	− 3·9
Merioneth	−15·6	− 4·4
Brecon	−18·0	− 2·1
Montgomery ..	−18·3	− 6·2
Denbigh	−19·4	+ 7·2
Glamorgan	−36·5	− 2·0
Radnor	−38·4	− 6·7
Monmouth	−57·0	− 3·0
Total. Wales ..	−22·8	− 0·1

It will be seen that between 1931 and 1951 there has been a percentage decrease of 22·8 of persons able to speak the Welsh language in Wales as a whole; some 200,000 less than the 909,000 recorded in 1931. In other words, there has been an average drop of 10,000 speaking Welsh in the Principality each year during the past twenty years as the total population of Wales, including Monmouthshire, aged three years and over in 1951 is much the same as it was in 1931 (2,472,000).

Table 1 shows the percentage in relation to population of those able to speak Welsh in 1951 to be lower in every county than it was in 1931. One is not surprised to find the transitional industrial counties of Glamorgan, Flint and Denbigh with the highest percentage decreases (between 9 and 12 per cent.) but it is strange to see Merioneth and Caernarvonshire linked with this group. Denbighshire and Flintshire in the industrial north-east of Wales had the largest increases in population during these two decades, while the absolute decrease in population of Glamorgan was nearly 23,000. Many bilingual Welsh families must have left Glamorgan during the period under review, especially from the coalmining valleys of its central and eastern parts. Although many people from the rural Welsh-speaking districts of North Wales must have settled in the counties of Flint and Denbigh, the greater proportion of their increased populations must have come from across the border or from the English-speaking districts of North Wales. Another important factor may be that the new generation tends to be monoglot English in speech in these two border counties. Industrial developments during the last war and post-war years in the towns of Bangor, Caernarvon and Llandudno Junction, together with the growth of the tourist towns along the north Wales coast, may explain the relatively large decrease of 9·4 per cent. in the essentially Welsh-speaking county of Caernarvon. The 10·1 per cent. decrease in Merioneth may well be due to the effects of the tourist industry and of the Services' land training

areas at Trawsfynydd and Tonfannau as well as to emigration from the depressed slate-quarrying district of Blaenau Ffestiniog. The average percentage decrease of 7·4 for the whole of Wales may reflect not only economic and demographic movements but also the influence of the home, the school, the church, the radio, the press, and the cultural institutions and societies generally.

The percentages shown on Table 2 need to be looked at carefully. The high percentages for Monmouthshire (57·0) and Radnorshire (38·4) could be anticipated as both counties were already anglicized in speech in 1931. The percentage change of −36·5 in Glamorgan, whose absolute population change shows a decrease of only 2 per cent. between 1931 and 1951, merits close examination. The populations of the prosperous and expanding lowland towns of Glamorgan including Port Talbot, Bridgend and Cardiff, which were predominantly English-speaking centres in 1931, have shown substantial increases between 1931 and 1951, whereas its central and eastern mining valleys suffered severely from the industrial depression of the inter-war years and lost many thousands of workers in the adolescent and middle-age groups by migration to London and the Home Counties, the South Coast towns and to the Midlands. These valleys were within the belt of linguistic transition in 1931; a new generation has grown up in an area in which the strength of the vernacular speech was already wavering and weak and most difficult to maintain in a conflict which was largely determined by economic forces. It is to be expected that the zone of mid-Glamorgan[1] lying between the lines Swansea–Neath–Resolven–Aberdare–Merthyr Tydfil and Port Talbot–Bridgend–Pontypridd will prove to be the area of greatest linguistic change in the county during the last twenty years when the Census returns are published in full.

The figures for Denbighshire and Flintshire in Table 2 are somewhat in contrast with each other. Flintshire increased its population, aged three years and over, by 28 per cent. between 1931 and 1951 and during the period the number of Welsh speakers decreased by 11·7 per cent.; the figures for the neighbouring county of Denbigh are respectively +7·2 and −19·4 per cent. One is tempted to suggest at this point that the action taken to maintain the Welsh language in Flintshire during the past twenty years has been far more effective and successful than it has been in Denbighshire.

Of the remaining counties only the figures for Pembrokeshire call for special mention. In this county there has been a small increase of both population and Welsh speakers which can possibly be explained by a movement of population into the county from the adjacent Welsh-speaking counties of Cardigan and Carmarthen. It is in refreshing contrast with the percentage decreases of Welsh-speaking persons both in the border counties of Brecon and Montgomery and in Caernarvonshire, Merioneth and Carmarthenshire, the very heartland of Welsh Wales.

Statistics reveal the changing canvas; rapidly in some areas and more gradually in others, but nevertheless relentlessly, the Welsh language is losing ground in the Principality. The number of monoglot Welsh speakers has decreased by nearly a half (47·8 per cent.) in the past twenty years and the number of those able to speak both Welsh and English by 19·7 per cent. (one in five). From the estimates of the one per cent. sample for 1951 one notices that monoglot Welshmen outnumber monoglot Welshwomen by nearly 6000 but that bilingual Welshmen are 12,000 fewer than the number of bilingual Welshwomen in

[1] See 'Archaeologia Cambrensis' (1935) 257–60; 'Linguistic Divides in South Wales,' 239–66.

Wales, including Monmouthshire. This may be a reflection of differing educational attainments or it may be that the bilingual Welshman found it easier to find work outside Wales than did his fellow countrymen who did not speak English.

Bilingualism in Wales seems inevitable but it may well be one stage towards the eventual extinction of the Welsh language unless the use of the vernacular speech can be invigorated and encouraged amongst the younger generations. The home and the school can be its salvation.

FROM THE *JOURNAL* A HUNDRED YEARS AGO

THE FOLLOWING extract is taken from the report on the return of Lady Franklin's vessel the *Prince Albert* under the command of William Kennedy from the Arctic regions: published in the *Journal*, 23 (1853) 122–9. Before sailing Kennedy concerted with Lady Franklin a plan to explore a restricted area to the west of Prince Regent Inlet for traces of Sir John Franklin. The *Prince Albert* was moored in Batty Bay, on the eastern shore of North Somerset, and a winter station built. From here a preliminary reconnaissance was organized to the southward early in 1852.

"On the 5th of January (the first occasion for which we had been long watching) when the ice had set sufficiently along the shores of the inlet to admit of travelling, a detachment of five men, including Mr. Bellot and myself, set out for Fury Beach, with the double object of ascertaining whether this had been a retreating point to any of Franklin's party, since Lieutenant Robinson's visit in 1849, when detached for that purpose from Sir James Ross' winter-quarters; and, in the event of our expectations in this respect not being realized, of making this our first depot for the more extended exploration we contemplated afterwards carrying out. The sun had disappeared at the ship on the 30th October and owing to the position of some high hills to the S., did not reappear till the 13th of February. This first, and all our other journeys during the next two months, were therefore performed chiefly by moonlight and by the guidance of the stars. The use of tents was discarded as a needless incumbrance. However well adapted they may be for spring travelling, I question the prudence of risking men's lives under them, in the terrible temperature and still more terrible snow-storms of midwinter in the Arctic regions. We invariably camped in snow houses, constructed after the Esquimaux fashion, which will be familiar to everyone from the prints and descriptions given of them in the narratives of Arctic voyagers. Snow is so perfect a non-conductor of heat that the burning of a common candle in one of these snow houses creates a perceptible increase of temperature. The heat derived from the flame of a gill and a half of spirits of wine, sufficient to boil a tea-kettle for six men, diffuses an agreable warmth (relatively at least to the temperature without), which is felt for the rest of the night. Of course great care must be taken to construct the houses perfectly impervious to the air; and this is done by some one within driving a thin rod through every interstice between the blocks of snow which admits the light, while one without follows his movements, plastering every chink over with soft snow, until the whole house is as airtight as an egg, yet sufficiently porous to admit of the needful ventilation."

THE DOMESDAY GEOGRAPHY OF EASTERN ENGLAND

THE DOMESDAY GEOGRAPHY OF EASTERN ENGLAND. By H. C. DARBY. *Cambridge University Press*, 1952. 9×6 *inches;* xiv+400 *pages; maps.* 55*s*

PROFESSOR DARBY'S BOOK is the first of a series designed to cover the whole of that part of England which was surveyed in 1086. The six counties which for the purpose of this publication constitute Eastern England presumably form a convenient geographical division, though historically they lack unity, for at least three types of social organization can be distinguished here in the eleventh century, and the area comprises the ancient Saxon kingdom of Essex, the Anglian kingdom of East Anglia, parts of which were intensively settled by Scandinavians in the ninth century, and portions of the Mercian kingdom——Lincolnshire forming part of the northern Danelaw where Scandinavian settlement was intensive, and Cambridge and Huntingdon belonging to the southern Danelaw where Danish influence was much less strong. The information extracted from Domesday book is discussed county by county and, so far as is practicable, the aspects selected for treatment are dealt with in the same order in each of the chapters relating to individual counties. In the final chapter is presented a summary of the conclusions reached concerning the region as a whole.

The sections relating to settlements, recorded population, ploughteams at work and teamlands, in which an attempt is made to assess relative prosperity and the relation between densities and the nature of the soil and other natural features, are some of the most important in the book, and though the conclusions reached, for example that the outstanding contrast in Lincolnshire is that between the low densities of the Fenland and the Isle of Axeholme on the one hand and the high densities of most of Kesteven and the Wolds on the other, are seldom unexpected, an immense amount of labour lies behind these studies. Totals of free tenants, *villani* (villagers), cottagers, slaves and others have been calculated afresh and no one who has attempted to compile statistics from Domesday Book is likely to underestimate this arduous task. It has been rightly said by scholars who are at pains to emphasize the value and unique character of Domesday that the great record does not lend itself to statistical analysis. None the less, it is useful to have new sets of figures, more accurate than those in Ellis and to be compared in some instances with those in the Victoria County Histories, and that they should be presented by one who acknowledges so fully that accuracy can seldom be claimed for figures based on Domesday. Professor Darby sets out clearly the difficulties which confront the scholar when he attempts to make generalizations about such matters as the distribution and density of population and relative prosperity in the eleventh century. There are errors and omissions in the Exchequer Domesday, and when other early surveys based on the material collected by the Domesday commissioners supply conflicting information, it is difficult or impossible to discover essential facts. As a rule the differences between figures in the *Inquisitio Comitatus Cantabrigiensis* and the *Inquisitio Eliensis* and Domesday are comparatively slight and are unlikely to affect generalizations made from Domesday alone, but this is not always so. One text of the *Inquisitio Eliensis* lists *servi* on some Huntingdonshire manors though none are recorded in the

Domesday Survey of this county, and if *servi* have been systematically omitted in Huntingdon, it is perhaps arguable that they may have been omitted in Lincolnshire where Domesday makes no reference to this class. In Cambridgeshire it seems that between 1066 and 1086 large numbers of sokemen have disappeared or been depressed into an inferior rank of society, and such a catastrophic consequence of the Norman Conquest is not impossible or wholly unlikely, but the interpretation of the evidence is not absolutely certain and the position in 1086 will always remain somewhat obscure. It is agreed that the peasantry and other classes enumerated in Domesday normally represent families, and that the figures must be multiplied by about four or five when we attempt to calculate the population, but historians are not in agreement concerning the *servi* who are held by some to be unmarried men working on the demesne. This may be correct, though the number of references to slaves in Anglo-Saxon laws suggests that the slaves were a more important section of the community than this view would allow, and it seems very unlikely that there were no families living in slavery. Comparison of Professor Darby's maps 101 and 102 shows that generalizations about density of population are not much affected by doubts concerning the *servi*, but attempts to calculate what percentage of the total population the members of this class formed, and generalizations about the distribution of the slaves in Eastern England (or any other region) are vitally affected by this uncertainty (see maps 103 and 104).

The interpretation of other material in Domesday having a bearing on the relative prosperity of the various parts of the region being studied is sometimes far from easy. That the Domesday ploughteams at work in 1066 or 1086, whether demesne ploughs or ploughs belonging to the men, are teams of eight oxen seems fairly certain in spite of some entries suggesting smaller teams. The "teamlands" or "ploughlands" of Domesday cannot, however, always be regarded as estimates of cultivable land, and these figures are difficult to use in this connection. Though the precise significance of the values of Domesday, whether given for two or three dates, is often far from clear, this information is of great importance and is deserving of more careful study, but it cannot always be used to estimate relative prosperity. In the "Eastern Counties", for instance, the complexities of the social organization of Lincolnshire, Norfolk and Suffolk make it impossible to interpret the figures on a "geographical basis". It is not necessary to conclude that no generalization can be made from evidence of this kind. Provided that the limitations of the material which Professor Darby stresses are borne in mind, the maps will be found helpful, but it is not easy to show on a map what is doubtful and most Domesday maps are in a greater or lesser degree misleading. To a map on which are shown all places mentioned in Domesday that can be identified with existing villages, hamlets and farms, no exception can be taken, even though such a map is usually incomplete since in most if not all counties Domesday records places which cannot be located today. A map on which the same places are represented by dots does not however necessarily give a true picture of settlements, for in many instances it is certain (when places not recorded in Domesday are mentioned in charters or other pre-Conquest material) or probable that a Domesday place-name represents more than one settlement in 1086. To what extent entries of this kind affect the general accuracy of the maps on which county populations are shown by circles "proportional to the population of each vill" is hard to say. It does not seem likely, however, that the deficiencies of Domesday explain why in certain areas (e.g. parts of Suffolk, p. 178) the distribution of the population and ploughteams is not quite that which a geological map would lead us to expect.

The ingenuity displayed by the Domesday scribes in employing a variety of different phrases and formulas to say the same thing has often been the subject of unfavourable comment by modern scholars. The variant formulas, both those attributable to different groups of commissioners and those for which the codifiers may be held responsible, certainly add to the difficulties of the maker of maps. The woodland of Eastern England is estimated in acres in most of Lincolnshire and parts of Cambridgeshire, by linear measurements in Huntingdonshire and some other districts, and by feed for swine in Norfolk, Suffolk, Essex and part of Cambridge. Hence for the map showing the woodland of the whole region several sets of symbols are employed, a method which is probably more accurate than any other. The maps of the woodland and meadow are more useful than the map showing the distribution of saltpans which is confessedly inaccurate and misleading, for some of the pans cannot possibly have been situated at inland places shown on the map, and the evidence from other parts of the country suggests that pans might be a considerable distance from the estates to which they were attached for fiscal purposes. It is easy to understand why historians fully alive to the importance of maps and writing as though they had maps "in their minds" have generally recoiled from giving the necessary instructions to the cartographer.

Maps do not constitute the only or perhaps the most important difference between the approaches of the historian and the geographer to Domesday Book. Both are interested in woods, meadows, and mills and fisheries and view the evidence relating to such matters in much the same way. They are both concerned with population, though the approaches here are not quite the same. The historian who reckons percentages makes the historical divisions the basis of his calculations, whereas the geographer may sometimes abandon them, as Professor Darby abandons the wapentakes of Lincolnshire in favour of artificial divisions which he devises on the basis of geological and other considerations. The adding up of the members of the various classes, sokemen, *villani* and others, is important to both, but the historian's task really begins when this is done, for these calculations are the preliminary to a study of social organization. Innumerable men and women are mentioned by name in Domesday and many pre-Conquest estates and post-Conquest fiefs can be reconstructed, while some information (though all too little) can be gleaned about the terms on which these lands were held. These are matters with which the historian but not the geographer is concerned. In some respects it seems doubtful whether mere listing and mapping is a very remunerative task. Though it is evident, when all the references to churches in Domesday are brought together, that they are not systematically recorded, these references to churches throw much light on the ecclesiastical organization of the eleventh century, but they must be studied against the background of the history of minsters and lesser churches of Anglo-Saxon England, and it may be doubted whether the sections on churches in Professor Darby's book convey much that is valuable or could mean much to anyone who is not provided with this background. The geographer's aim is more limited, but he is in consequence compelled to study Domesday more or less in isolation, whereas the historian must draw on earlier and later materials. Both find the great Survey very defective, but both must acknowledge that their difficulties are to some extent of their own making, for they are attempting to extract from the record much which, owing to its very nature, it is incapable of giving.

Though "Domesday geography" is not, except in a very limited sense, history, it is to a considerable extent the outcome of historical studies, and students of history will find Professor Darby's book a wealth of useful information. The

author's caution commends itself to the reader, and as a rule the danger of over-simplification is avoided, though the problems connected with the making of the Survey are probably much further from solution than the introductory chapter would seem to suggest. The maps may sometimes give the impression that we know more than in fact we do, but they add materially to the value of the volume. In the hands of a scholar without Professor Darby's firm grasp of Domesday problems, the preparation of a Domesday geography of England would have been a very rash project. It is therefore all the more pleasing to welcome this first volume as a useful contribution to the study of England in the eleventh century.

R. R. DARLINGTON

AN ANGLO-CHINESE TOWN

HONG KONG. By HAROLD INGRAMS. *London: Her Majesty's Stationery Office* 1952. $8\frac{1}{2} \times 5\frac{1}{4}$ *inches;* xii + 308 *pages; maps and illustrations.* 27*s* 6*d*

THIS BOOK IS described as the first of a series of illustrated volumes on the Crown Colonies undertaken under the auspices of the Colonial Office and designated the Corona Library. The Foreword is provided by the present Colonial Secretary, Oliver Lyttelton; but the true parent is Creech Jones, his predecessor. The venture may therefore perhaps be described as "bi-partisan."

It is explained on the fly-leaf that the series is intended to fill the gap between official blue-books on the one hand and "the writings of occasional visitors" on the other. It may be doubted whether this inaugural volume really fills this bill. The author himself tells us that he arrived, by air, on 8 March 1950, and departed again on May 8, a visit of exactly two months. As this seems to have been the only occasion on which he has visited the Colony he seems to fall neatly into the category of "occasional visitor." The distinction therefore between this work and the ordinary efforts of visitors lies simply in the fact that this visit was undertaken at the invitation of the Colonial Office, and this account of the visit is sponsored by that Office, and financed by the British taxpayer.

As to my own qualifications as a reviewer I should explain that I knew Hong Kong at close quarters from just before the Revolution in 1911 to shortly before the outbreak of the Second World War in 1939. I can therefore perhaps claim to have more than a passing acquaintance with the colony. But clearly my knowledge is by no means up to date; and no one knows better than I how rapidly things may change on the China coast.

From Mr. Ingrams' teeming pages I single out three topics which seem to have particularly interested him and may perhaps interest his readers; Overcrowding, Constitutional Reform, and what may be described as "get-together." Overcrowding by Chinese immigrants is an old complaint. As early as 1845 the 'Chinese Repository' described the place as "improving and rising rapidly—but the fear is it will outgrow itself." It is particularly cruel luck that at a time when she needs a period of convalescence under the care of old and trusted friends to set her on her feet once more the complaint should have broken out again with such virulence. Mr. Ingrams, while acknowledging the benevolent paternalism of the Government and the charitable feelings of its merchants, endeavours to lay down the principle that the Colony "cannot properly divest itself of full responsibility for those it lets in; for its deliberate policy has drawn them there"; and demands at once an indefinite extension of its welfare services. A good

deal, I conceive, hangs on what one means by "drawing" and "deliberate policy"; and, sensing that here is a problem calling for almost superhuman sagacity, I have ventured to see if China's greatest sage has any guidance to offer. In Book 13, chapter 16 of the *Lun Yü* (Analects) I find: "The Duke of She asked about good government. The Master said: 'Those on the spot are happy; those that are far off pour in.'" I do not doubt that that accounts for the embarrassing attraction of Hong Kong. Some come to see the sights and the lights, as farmers flock to Blackpool; I daresay a few come, or are sent, to make trouble; but the vast majority come simply to scratch a humble but honest living in comparative security.

Turning to Constitutional reform Mr. Ingrams reaches the disappointing conclusion that nobody seems to want it. But those who knew the Administrative service when it was strictly limited to native-born Englishmen will see in the appointment of a Chinese to the post of Assistant Secretary of Chinese Affairs and of another to be District Officer in charge of the Southern District of the New Territories a note of striking novelty; and I venture to think it an advance in exactly the right direction. The great structure of the Chinese civil service of which China was so proud was essentially democratic. It offered to the humblest prospects of reaching the heights provided they had the brains and the industry sufficient to pass a stiff literary examination. And those Englishmen who have had the privilege of sharing with Chinese gentlemen the executive tasks of Government know well with what gravity and shrewdness they undertake the duty. On the other hand the type of democracy which means popularly elected parliaments is historically quite alien to China. If the individuals appointed by Authority to represent the people do not in fact do so there are ways and means—perhaps unheard of in the West—of letting Authority know.

Thirdly, "get-together." I gather that, apart from the familiar gibes at Peak dwellers, Mr. Ingrams' chief regret is that there are not closer Anglo-Chinese contacts in the middle levels of society. Agreed; but friendship is a delicate flower and will not stand forcing. It is not just a matter of shyness. The truth is that in Hong Kong two races each with a highly developed superiority complex face one another. Besides, the two have very different ideas of what is desirable in such personal matters, for example, as food—Mr. Ingrams details rats, cats, dogs and monkeys' brains as items of Chinese diet—and music.

Before leaving the subject it may perhaps be appropriate to recall a few of the historical facts about the residential reservations of Hong Kong. Originally without part or lot in the centre of the town, for the simple reason that Elliot's original land sales were—not unnaturally—open only to Europeans, the Chinese were in turn soon allotted sites in contiguous areas. In fact the old Factory system so familiar in Canton by which the visitor from overseas was strictly confined without the gate, was closely reproduced in Hong Kong; with this difference, of course, that in the Colony it was the English who occupied the centre of the stage, the Chinese who took the wings. A generation or so later, in the consulship of Hennessy, the hard-and-fast line drawn around this *de facto* European reserve was in part relaxed, the business section of the Central District being officially pronounced accessible to Chinese purchasers and Chinese occupants. Ten years later, the European main body having meanwhile retired to the hills, the position of the residential section on the mid-levels was in turn reviewed by Governor Des Voeux. A "European Reservation" was created: a reservation which, so far from excluding Chinese, expressly admitted them on terms—namely the acceptance of European living conditions—to territory hitherto closed to them. In 1904—the First of Nathan—the exclusively European retreat on the Peak was in turn accorded *de jure* recognition as

such. But fourteen years later Governor May reversed the step, substituting for the Peak Reservation Ordinance a Peak Residence Ordinance which demanded of all who desired to reside in the old European reserve that they submit their claim to the Governor's decision. A striking change indeed! but then in those fourteen years, and notably in the years following the Revolution, many new things had occurred; and among them is to be detected a palpable *rapprochement* in the relationship of the two communities.

The above brief synopsis may perhaps serve as an example of the usefulness now and then of probing a little below the surface. Mr. Ingrams gives us a vivid little *vignette* of the main street of Sha T'ou Kok where "Imperialist Britain" faces Communist China. It would have added some piquancy to his account had he been in a position to recall—a fact for which I personally can vouch—that in the early days of 1927 the hammer and sickle could also have been seen floating above the pawnshop at the end of the street: a fragment of past history which might have evoked some interesting reflections on the mutability of human affairs.

Of the illustrations with which the book is enlivened, the photographs are technically excellent and mainly well chosen; though I must make a reservation about one which purports to show new flats on the Peak for Civil Servants. I observe on the skyline a tall block which is quite new to me, but the sumptuous building in the foreground was in my day a hospital built to commemorate the dead of the First World War. Maybe it has since been converted. Nor am I quite happy about the three coloured topographical prints which claim to be reproductions from the originals in the Chater collection. My information is that this collection was looted at the time of the Japanese occupation and has not been heard of since. If that is so it would seem that these plates are not reproductions of those charming originals but copies of the small reproductions in the Catalogue of the Collection. Two of the three—the lithograph of the Praya Grande in Macao and the aquatint of the north-west view of Victoria—strike me also as rather crudely coloured. On the other hand I like unreservedly the contou map, in the folder at the back, of the Colony including the New Territories. It evokes many nostalgic memories. G. R. SAYER

REVIEWS

EUROPE

CLIMATOLOGICAL ATLAS OF THE BRITISH ISLES. *London: Her Majesty's Stationery Office*, 1952. 12×10 *inches;* 139 *pages.* 52*s* 6*d*

This admirably produced comprehensive atlas with its clear plates and diagrams, its instructive letterpress, and its full bibliographies will contribute much to the spread of more accurate knowledge of the climate of the British Isles. It forms an indispensable companion to E. G. Bilham's 'The Climate of the British Isles' and G. Manley's 'Climate and the British Scene,' but its usefulness is not merely academic. The National Agricultural Advisory Council have shown much interest in the preparation of the Atlas and urged its importance in the development of agriculture. It has too a direct significance for other practical purposes; those concerned with siting new towns and industries, with building and extending airfields, even with planning holidays may consult its pages with profit.

The atlas has a full series of maps illustrating for each month the average conditions of pressure, temperature, rainfall and sunshine based upon records for the thirty-year period, 1901–30. It is convenient to have collected, and in the most reliable form, the distribution maps of climatic elements long familiar, but it is even more interesting to find here produced many less familiar maps. The excellent series illustrating snowfall emphasizes facts of distribution of great practical importance, and the maps of the monthly average means of vapour pressure, relative humidity and saturation deficit form another valuable and unusual group. The maps showing the distribution of the average number of days on which thunder is heard are more detailed than any previously published; they are based on the records of 200 stations. The increasing interest in conditions of visibility and the occurrence of fog makes the maps illustrating the distribution of these worth while in spite of the incompleteness of the data which limits the representation of conditions to areas below 500 feet, and even on the low ground the isopleths in some areas may be unduly generalized. Wind, so variable in speed and direction from time to time and from place to place, is perhaps the most difficult element to map effectively. It is therefore not surprising that the section on wind should be the least satisfactory in the atlas.

The makers of the atlas recognize that maps of average conditions however skilfully selected, cannot illustrate adequately the local capriciousness of the British climate. Maps of weather conditions in certain small areas and of individual storms, some typical, some extraordinary, have therefore been included. There are charts of pressure on typical days, and more unusual illustrations of particularly heavy rainfalls, and of the great snowfall of Christmas 1927 which deserve careful study.

In congratulating the Air Ministry on the publication of this atlas, "the first reasonably complete climatological atlas of the British Isles," we should remember also the numerous voluntary observers without whose "co-operation and accurate work," as the Director states in his preface, the atlas could not have been produced in all its present detail. J. B. M.

THE SEA COAST (The New Naturalist series). By J. A. STEERS. *London: Collins*, 1953. $8\frac{1}{2}\times5\frac{3}{4}$ *inches;* xii+276 *pages; maps, diagrams and illustrations.* 25*s*

This book deals comprehensively, and apparently for the first time, with the physiography of the entire coast of England, Wales and Scotland, including

their islands and the Isle of Man. Part of the ground was covered, in greater detail, by Professor Steers in his 'Coastline of England and Wales' (Cambridge, 1946), but the introduction of Scotland has immensely improved the balance of this new book. A far wider variety of scenery and structure are now surveyed; the Border no longer prevents the magnificent cliffs of Berwickshire from taking their rightful place in the discussion beside the cliffs of North Devon; while problems of raised beaches, and of the former connections with the continent and with Ireland, are illuminated. There is now a much fuller treatment of cliffed coasts and their evolution, although the amount of detailed work that has been done on the east coast of England, especially by Professor Steers himself, results in more space being still devoted to sand and shingle spits and salt marshes than to cliff scenery; but the author emphasizes that the Norfolk marshes have been treated at length in order to illustrate principles which may be applied to similar coasts elsewhere. Some readers may feel, however, that the space occupied by tables showing marsh accretion measured to the nearest tenth of a millimetre over certain periods, might have been used more profitably, perhaps in part for a fuller description of the New Red Sandstone cliffs familiar to all travellers on the Western Region railway between Exeter and Plymouth.

Black and white plates and colour photographs bring the coast before the reader's eye. The former are an excellent series, ranging from aerial views to close-up portraits of individual halophytes. The colour photographs, on the other hand, are marred by a certain uniformity and coarseness of reproduction. An erratum slip draws attention to the unlucky fact that the titles and descriptions of Plates 3 and 4 have been reversed. An odd impression produced by the geological map of the British Isles is explained when one notices that the Outer Hebrides have somehow been omitted. In many of the maps the lettering is too small to be read easily, and a greater number of names on the maps would in some cases have made it easier to follow the descriptions. The index is somewhat inadequate, which is particularly unfortunate as only a part of the book is arranged topographically. That it is necessary to make these detailed criticisms is a measure of the value of the book and of the closeness with which it will be studied and used for reference.

A striking feature is the discussion, in the last chapter, of the sinking of the land in south-east England and in Holland, and the rising of north and west Britain and of the Baltic coast. The cautious warning that, in consequence, increased floods are now a possibility to be borne in mind, can be read as a prophecy of the drastic events of 31 January 1953, which occurred after the words had been written. For the importance of this topic alone, the book, apart from all its other merits, deserves to be deeply pondered.

Professor Steers emphasizes the vast complexity of the evidence for relative uplift and depression. He recognizes that the time is not yet ripe for an attempt at a general correlation, but his book will stimulate the further work that must be done, especially in Scotland, before we can claim a full knowledge of how our coast has come into being. M. A. A.

THE WEALD. (The New Naturalist series.) By S. W. WOOLDRIDGE and FREDERICK GOLDRING. *London: Collins*, 1953. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* x+276 *pages; maps, diagrams and illustrations.* 25*s*

The sequence of chapters in this book takes the reader first from the geological history of the region and its physiographical development to its soils and hydrology. Vegetation communities are then considered in relation to the previous subjects, followed by animal life. Man is treated as a member of the

Pleistocene fauna, then traced through successive elevations in his estate to the Anglo-Saxon settlement. Village geography is discussed with reference to place-names and soils, and there are chapters on towns, roads, industries, agriculture and forestry. There is then a chapter of conclusions. Finally there is an appendix on base exchange and soil reaction, and another entitled observations and notes on some animals of the Weald (by J. H. P. Sankey), followed by a bibliography and an index. Sixteen most attractive plates in colour and twenty-five in black-and-white by one of the authors (Goldring) embellish the book, and there are fifty-three maps and diagrams.

Taking the book with him, the reviewer visited the Weald. He would like to have had a clear idea as to authorship of given parts of the book, but felt humbled by the joint knowledge of places and things. He yearned for a good map, and wished he had taken a complete set of ¼-inch and 1-inch maps of the area south of the Thames and east of Portsmouth in his pocket; the publishers might use the end-papers to some effect in another edition. Moreover he asked himself for whom the book had been written, and decided that it was for the educated person who had some personal knowledge of the Weald; it seemed scarcely adapted to the expert in any field, and would be heavy going for those still at school. But for the remainder of literate society at least some chapters would be both interesting and instructive.

So the reviewer, a geologist, found the early chapters well worn and slightly pontifical, and the remainder progressively enthralling; no doubt the archaeologist and the human geographer would have similar experiences in reverse order. Much that is said is applicable and valuable outside the context of the Weald, for example the chapters on soils and vegetation communities.

The essential thesis of the book, however, is that all these diverse yet interdependent philosophies are welded by the authors into an aggregated conception, which indeed is the geography of the region. To the reviewer it is an impressive operation, even if the patient suffers here and there from bad attacks of place-names that he cannot readily locate—or retain in his mind unless or until the Weald has become his parish.

The publishers have set a high standard, and the minor errors that have escaped them and the authors are unworthy of mention here.

The book should be a favourite with those who dwell in the Weald and those who can descend frequently upon it from London; they can absorb and review the contents at their leisure. K. S. S.

THE CHANNEL SHORE. By AUBREY DE SELINCOURT. *London: Robert Hale, Ltd.*, 1953. $8\frac{1}{2} \times 5\frac{1}{4}$ *inches;* x+229 *pages; maps and illustrations.* 18*s*

Messrs. Robert Hale, Ltd., famous for the County Books, have now sponsored a new series of Regional Books dealing with individual and well-marked areas lying across the County boundaries. This is a policy which the geographer, always conscious of artificial boundaries, will warmly welcome. But the inclusion of a book on the Channel shore in a series which is to deal with such well known and commonly accepted geographical entities as the Fenland, Breckland, Dartmoor and the Weald may cause some surprise. The Channel shore is but half the unity of the English Channel.

Aubrey de Selincourt is, amongst other occupations, a keen yachtsman and his survey of the Channel shore becomes a pot-pourri of yachting experience, personal reminiscences, historical and geographical comments and topographical descriptions as he goes westwards along the shore from Dover to Land's End. Although the expert may feel that some of the explanatory passages on coastal morphology, on tidal changes and on disputed historical points leave much to

be desired, for the layman the book is undoubtedly a well written, pleasant and very readable account of the south coast. It will for many people, and especially yachtsmen, bring back happy memories of well known and loved places. Throughout the book the author approaches each area from the sea itself and the reader rapidly gains the illusion of a cruise along the Channel shore.

For full appreciation, however, a study of this kind needs large-scale maps: with several hundred miles of coast involved this presents the publisher with a well-nigh insoluble problem. The sketch-maps provided show the main towns but a careful selection of extracts from larger scale charts and maps would undoubtedly capture for the general reader more of the intricacies and atmosphere of the coast. The book also contains twenty-five photographs but there is no reference to these in the text. W. G. V. B.

THE RUHR: a study in historical and economic geography. By N. J. G. POUNDS. *London: Faber & Faber*, 1952. $8\frac{1}{2} \times 5\frac{1}{4}$ *inches;* 283 *pages; maps and diagrams.* 25*s*

To produce a balanced and succinct geographical treatment of the largest and most closely integrated industrial area in Europe, if not in the world, is not a light task but Dr. Pounds has succeeded in doing so and the result is a well-planned and competent study. After a short preliminary chapter on the location and general significance of the Ruhr, conditions in the area are examined in detail at three representative dates, 1800, 1850 and 1900.

On this basis the main stages in the growth of heavy industry upon the coalfield following the earlier phase of small scale iron-working, accompanied by textile manufacturing in the valleys to the south, in the Sieg and Sauerland with their local ores, hardwood fuel and power-giving streams, are clearly and systematically traced. A significant difference between England and Germany at the beginning of the nineteenth century was that in the latter coal was little used and the Ruhr itself at that time had not begun to attract industrial development. Even by the mid-century, following the initiative of local men like Krupp at Essen and newcomers like Mayer at Bochum, coal production, still largely a rural activity, gave only limited support to the industry which by now had advanced to the Ruhr. A very different picture is presented for 1900, due to Germany's acquisition of part of the Lorraine ore reserves in 1871, the discovery of the basic process in steel making and a spectacular increase in coal-mining.

From this point the author examines separately and more fully the present-day conditions affecting the coal industry, the iron and steel industry, transport (must it be called transportation?) and some aspects of social geography. A final chapter dealing with the Ruhr in relation to the economy and politics of Europe is less satisfactory, for while it is doubtless intended to round off the geographical survey, in many respects it opens new and inappropriate ground, necessarily raising controversial issues, such as the role of the industrialists in Germany's preparation for the Second World War. Even here however there is one conclusion which emerges convincingly from the entire study and which must be accepted by those concerned with future policy: the Ruhr, which is as much an industrial organization as a geographical region, must be preserved as a unit, for its industries are so closely integrated that "to interfere with one would be to reduce the efficiency of all."

On lesser points it might be said that in a few places the author's handling of the physical background lacks firmness of touch and on page 24 the observations on *loess* seem to be contrary to the conclusions arrived at in the reference quoted. In any case these matters do not seriously detract from the high

standard of scholarship attained in this study, which is illustrated by clear and well-constructed maps and diagrams and which may be regarded as indispensable for the understanding of the growth of modern Germany.

The plan of this book raises an interesting point in methodology for it is an admirable instance of the historical treatment directed towards the elucidation of the character of a region in terms of processes which operate of necessity through periods of time. It supports the view, now increasingly held and recently emphasized by Professor Preston E. James (Annals of the Association of American Geographers, XLII, September 1952, p. 204) asserting the inseparability of historical geography from regional geography. K. C. E.

GREEN GOLD AND GRANITE: a background to Finland. By WENDY HALL. *London: Max Parrish*, 1953. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 190 pages; maps and illustrations. 17s 6d*

Finland has an unenviable position on the map of Europe but its people have come successfully through many adverse times; Miss Hall's account suggests that they retain the resilience of former years. The author states modestly that her book "does not claim to be more than a general background" and she tells her story pleasantly. It may be that at times the picture appears almost too rosy: the extreme north, for example, was described by an UNRRA representative as "the most devastated area in Europe" yet according to the author "each man's hands were turned to the making of his own wooden dwelling-house" and Rovaniemi, on the Arctic circle, has been rebuilt as a fine modern town of 14,000 people (p. 69), incidentally more than before the war. And almost half-a-million people have been evacuated from areas ceded to Russia, many of whom have been given new farms.

There are many interesting observations in this book: the author thinks the Saarinen railway station, the red granite parliament house and the enormous Post Office of Helsinki too pretentious for a capital of 400,000 people (pp. 24–5); she found Tampere, "the Manchester of Finland . . . a clean and well-planned city . . . its modern factory windows looking through pine trees on to islands and water . . . many of its citizens, who learnt their technique in Manchester and the north, speak an English which has the homely note of Lancashire. . . ." Much of this has been said before, but the frank style of the writing will please readers. This is not a book of depth, but rather of charm: the author deals appreciatively with the arts but says little of the stern athleticism of the Finns. But can anyone really believe that "all other things being equal, Finland could support a population of fourteen millions, instead of the four millions she now counts" (p. 162)? It may be that industry will develop still further and that factories will be placed in the countryside rather than in towns and that its people will be able to strike a fortunate balance between industry and agriculture, between town and country. To the reviewer this book has given great pleasure, but he wonders if things really are as good as they seemed to its author. T. W. F.

ASIA

CARAVAN: the story of the Middle East. By CARLETON S. COON. *London: Jonathan Cape*, 1952. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* viii+376 *pages; maps, diagrams and illustrations. 28s*

THE ARABS AND THE WEST. By CLARE HOLLINGWORTH. *London: Methuen & Co.*, 1952. $8 \times 5\frac{1}{4}$ *inches;* xi+285 *pages; maps. 21s*

Ignorance of local customs and beliefs and social aloofness are said to be the besetting sins of Europeans and Americans whom official duties or business or

love of travel take to the Middle East, and political relations have often been embittered by bad manners springing from a half-pitying half-contemptuous attitude towards "backward" people who yet have a legitimate pride as inheritors of an ancient civilization. Professor Coon of the University of Pennsylvania has written a book admirably designed to dispel ignorance and to promote a sympathetic understanding of the Muslim way of life. Written primarily for Americans it can also be strongly recommended to British readers. The author's special subject is anthropology, and he has successfully demonstrated "the practicability of the technique of applied anthropology in complex, literate civilizations as well as in simple, pre-literate cultures." He has travelled much and read much, and in fields where he is not a specialist he has made good use of the erudition of others, yet he carries his learning lightly and succeeds in being accurate without pedantry.

Ranging from Persia to Morocco he gives an illuminating account of manners and customs and the ordering of the social and economic life. There are also chapters on history and racial origins and on the tenets and institutions of Islam. The civilization he describes is the traditional and tradition-bound civilization of the Muslim world, as it was before the impact of the west was felt, and as in many essential features it still remains. The writing is refreshingly unconventional, and what he has written is not a text-book but an *oeuvre de vulgarisation* in the best sense of the term.

Miss Hollingworth in 'The Arabs and the West' also calls for "an entirely new approach to personal relationships with the people of the Middle East if they are to be rid of their feeling of inferiority and therefore hostility and suspicion." She has studied the political history of the Arab world during ten fateful years, and her book will chiefly appeal to readers who require a commentary on the day-to-day news which will render the course of events more intelligible. Economic factors and political trends are examined from first-hand observation, and stress is laid on the instability of Arab regimes and the danger of revolutionary chaos, whether Communist-inspired or springing spontaneously from the desperate plight of the submerged classes. The author's observations, on the whole, remain close to the surface, and there is little awareness of the existence of constructive forces which may yet emerge into the light of day from the present ferment. S. H.

ANNAPURNA. By M. HERZOG. *London: Jonathan Cape*, 1952. 8×5¼ *inches;* 288 *pages; maps and illustrations.* 15*s*

NEPAL HIMALAYA. By H. W. TILMAN. *Cambridge University Press*, 1952. 8½×5½ *inches;* xii+272 *pages; maps and illustrations.* 25*s*

THE MOUNT EVEREST RECONNAISSANCE EXPEDITION, 1951. By E. SHIPTON. *London: Hodder & Stoughton*, 1952. 10½×8½ *inches;* 128 *pages; maps and illustrations.* 25*s*

Maurice Herzog's 'Annapurna' is above all a disturbing book. In plan and execution, his expedition shook a good many accepted notions about attempting high Himalayan peaks—and by "high" the arbitrary minimum figure of 8000 metres, so much in evidence in the book, will nowadays do very well. It is at such a height that amateurishness might spell disaster. Although the margin was horrifyingly slender there was no disaster on Annapurna. Indeed, the double achievement in a single season of finding the approaches and climbing the mountain is unique in the history of mountain travel.

But some questions pose themselves, and M. Herzog's book does not quite give the answer. Was it entirely justifiable to mount the eventual assault with only twelve days' margin from the Base Camp? Other questions follow from

it. Should men who are later going high (including porters) ever be used for such strenuous work on the lower glaciers? What of the long distance from top camp to summit? Given that, would not a bigger margin of spare clothing have made a more suitable load than the considerable photographic equipment? There is no avoiding the conclusion that the high climbers were very vulnerable indeed; the results fill the last hundred pages of the book with appalling emphasis.

If one cannot escape from these questions, nevertheless a deep impression is left by the evident determination and comradeship among those who took part, and in particular by the leader's fighting qualities. The book is very moderately priced, lavishly illustrated, and has a properly folded map in the right place (the end) which really does show with complete clarity where the party went; points to be noted with some shame by publishers of other recent travel books.

Tilman in his 'Nepal Himalaya' throws an interesting light on Herzog's expedition. Tilman was still moving at a good height in the Annapurna massif some time after the French had left, and one wonders if the French gave too much weight to the monsoon threat, since it was this which caused their rush tactics. In contrast to Herzog, Tilman's familiar reticence leaves the reader with much to fill in for himself. His plain and direct tales are three: a highly interesting exploration of the Langtang area, an attempt on the baffling Marsyandi face of Annapurna, and the now historic first glimpse of Everest's southern precipices. Of the last, it is well to be reminded, in view of all that has come of it, that this journey was an American enterprise. Not the least interest of Tilman's book is his admission that science is not after all the enemy; although his learned note on a cluster of *mecanopsis horridula* (of all things), imposes a strain on the credulity if one knows more about Tilmanic humour than about botany. As always, the publishers produce him handsomely and at a stiff price; as always, they have tucked away some dreadfully small maps much too inaccessibly. Tilman should agree with his cartographer whether it is to be Muktinath or Maktinath.

Shipton's record of the 1951 Reconnaissance to Everest was well worth the making. Restraint is again the keynote. His part of the book is impeccable; the narrative is a pleasure to read and the material of great interest. In particular his description of the first early morning scene at Thyangbochi is a piece of evocative writing of the highest quality. His illustrations too are well chosen. The pity of it is that the whole should be marred on the production side. The photographs are unworthily reproduced and the outrage is committed of "bleeding off" to the edge of the page, resulting in loss of some part of the picture in the final trimming of the bound book. A further portion is lost among the binding at the centre. Sometimes the effect is grotesque, as when on the left page the rugged and tangled jungle of the Dudh Valley merges almost indistinguishably with the tangled and rugged (and almost lifesize) beard of the leader on the right. Both are magnificent but, like jam and cheese, are better absorbed separately.

In short, of three exceptionally valuable records, two are badly shown up in their separate ways by the third in the matter of cost and presentation.

T. A. B.

THE STORY OF EVEREST 1921–1952. By W. H. MURRAY. *London: J. M. Dent & Sons*, 1953. $8\frac{1}{4} \times 5\frac{1}{4}$ *inches;* 193 *pages; sketch-maps and photographs.* 15*s*

Colonel John Hunt, before starting on his brilliant achievement this year, made clear how much any successful expedition would owe to its predecessors.

Mallory, after the first reconnaissance in 1921, wrote that, in order to win through, climbers must have good fortune and "some constant spirit of kindness in Mount Everest itself, the forgetfulness for long enough of its most cruel moods." Mr. Murray has written a lucid and well-balanced summary of the intervening years illustrating how true are these two statements.

The story naturally falls into three parts: (i) The expeditions of 1921 (Howard-Bury), 1922 (Bruce), and 1924 (Bruce and Norton), which rightly occupy more than half the book, since these produced the fundamental knowledge for ultimate success; (ii) The expeditions of 1933 (Ruttledge), 1935 (Shipton), 1936 (Ruttledge) and 1938 (Tilman), which digested, put to the test, and added to that knowledge; these might well have occupied more than the 30 pages devoted to them, though some were completely marred by impossible weather; and (iii) the post-war ventures from Nepal—Tilman's rapid reconnaissance of 1949, Shipton's exploration of the south-west approach in 1951 (in which the author took part) and the two all-out Swiss assaults in 1952, which put into practice most, but not quite all, of the accumulated knowledge; these ventures occupy some 40 pages. There were six assault expeditions and four reconnaissance expeditions in 31 years, some of them extending into the post-monsoon period. Some 10 climbers have been within striking distance of the top. In the ten years when parties were in the region, probably four only had weather favourable to success—1921, which was devoted entirely to a first reconnaissance; 1924, when the party was exhausted by premature attempts to reach the North Col too early in May, which prejudiced the assaults of Somervell and Norton and of Mallory and Irvine; 1933, when Smythe and Shipton, Wyn Harris and Wager failed to reach the summit primarily through bad snow conditions and high winds above 27,000 feet; and 1952, for the Swiss attempts. It is so much easier now to assess the causes of early errors because of the experience gained from them: the avalanche tragedy of 1922 was almost certainly caused by lack of experience of Himalayan snow conditions among first-class Alpine climbers; inadequate news of the monsoon's progress in 1924 led to the premature moves of that year.

But the lessons were not learnt easily: in the 'thirties there were the protagonists of the large expedition and the small, of the need and uselessness of oxygen equipment, of "siege" and "rush" tactics, of pre- and post-monsoon assaults. There was some truth on all sides in these discussions, which were thrashed out by the Mount Everest Committee and the Alpine Club after each assault in consultation with the climbers; most opinions have now been well tried out on the ground. Probably the gradual accumulation of physiological knowledge, particularly in the widely varying rates of acclimatization and deterioration in individuals—first emphasized by Odell's amazing performance in 1924—and the hard-won knowledge that Everest only forgets her cruellest moods for perhaps three weeks in the year, when the high west winds are being subdued by pre-monsoon air-currents—these lessons learnt in the bitter school of the northern approaches, combined with brilliant leadership, have more than any other factors laid the foundation of success in 1953.

The author has compiled his story from the essential mountaineering facts both of the official accounts and of personal narratives. Without in any way detracting from the outstanding contributions of Mallory and Bullock in 1921 more space might perhaps have been devoted to the solid work of other members of this expedition, notably of Morshead and Wheeler. It was the latter who discovered and first mapped the East Rongbuk glacier and so laid the foundation of the approach in 1922. More mention might also have been made of the influence of Sir Francis Younghusband, to whom all the early leaders expressed

their devotion and gratitude. These names and those of Bruce and Longstaff, whose advice on the Mount Everest Committee was always weighty, as well as those of the leaders of later days, Ruttledge, Tilman and Shipton, are great in the epic of Everest. Incidentally the name Morshead is incorrectly spelt *Morsehead* throughout the book, a fault often made by *The Times* and sometimes found in other modern writings on Everest. The photographs, taken on the various expeditions, have been carefully chosen and the sketch-maps are excellent. The author is slightly amiss in his brief note on Everest's height (p. 2). So far as is known to-day after a hundred years of scientific analysis, the official height, 29,002 feet, is much nearer the truth than the provisional height (29,141 feet), very tentatively suggested by Burrard fifty years ago. To put it crudely, the summit may be observed with a theodolite with considerable exactness, and within certain limits the observations can be corrected for refraction; but the exact position of "mean sea level" beneath the mountain—the separation of the geoid from the spheroid adopted for the computations—is not yet exactly known; and no aneroid or other readings dependent on atmospheric pressure in the disturbed weather conditions of the Mount Everest region can possibly improve on the official height. K. M.

AMERICA

EXPLORATION FAWCETT. By Col. P. H. Fawcett. *London: Hutchinson*, 1953. 9×6 *inches;* xv+312 *pages; end paper maps and illustrations.* 15*s.*

This book consists of the diary of Col. Fawcett, edited by his son Brian who contributes a concluding chapter. Only a small part of the book deals with Col. Fawcett's expeditions into Matto Grosso which have attracted so much public attention, the rest being taken up with his earlier work on the frontiers of Brazil, Bolivia and Peru. This warning is necessary, because the book opens with an exposé of the historical evidence for "Lost Cities" in the interior of Brazil, and is followed by a rather vague chapter devoted to a psychometrist's interpretation of a basalt figure of Brazilian Indian origin. Most readers will prefer to reserve their judgment on these questions of Indian origins, and on the existence of the "Lost Cities", and the degree of reliability to be attached to the evidence for them.

The real interest of the book is different. Fawcett sailed for Peru in 1906, in order to plot the demarcation of parts of the Bolivian–Peruvian frontier; Bolivia had requested the Royal Geographical Society to act as referee and the task was accepted by Fawcett. From then up to the First World War he was continuously at work in this and adjacent areas. These remote forests came to have such a hold upon him that he broke his career in the Army, and his later journeys were made entirely on his own responsibility. He came to know the Acre, the Madre de Dios, the Heath, the Madidi and other rivers of the Caupolicán, or north-eastern forest of Bolivia, more intimately than any other qualified traveller of his time, and he made notable contributions to the mapping of these areas. He crossed the Bolivian plains from the Beni to the Mamoré, and from the latter to the Paraguay. He explored, amid bitter and distressing circumstances, the Rio Verde and the Upper Guaporé—a disputed sector of the Brazil–Bolivia frontier. All through these years his convictions about the "Lost Cities" grew upon him. Even before his expedition in Matto Grosso in 1924 from which he has never returned, he had travelled on the same quest in the area east of the São Francisco river. His son, reviewing the evidence of his

disappearance, concludes that no satisfactory explanation has been forthcoming, and that the circumstances of his fate remain unknown.

The account of Fawcett's early years in this book is a valuable document, for it gives a vivid, indeed graphic, impression of the chaotic state of administration and of social life in the Bolivian (and Brazilian) forests before the fall of the wild rubber market in 1913–14. Nor is this account seriously weakened by the somewhat jerky and unconnected, but very forcible style in which it is written.

Fawcett marked the end of an age. One might almost call him the last of the individualist explorers. The day of the aeroplane, the radio, the organized and heavily financed modern expedition had not arrived. With him, it was the heroic story of a man against the forest. The present reviewer has a vivid recollection of him. He was of the stuff that pioneers are made of; a visionary and an enthusiast, he never succeeded in carrying with him any serious body of opinion about the former Indian civilizations of the interior. He was not always an easy companion in the tedious marches and the long nights. But he knew the interior of South America as did very few of his contemporaries, and far better than many of his critics. And his record of solid work done is one that merits respect.

K. G. G.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

DETERMINATION OF AZIMUTH AND LATITUDE FROM OBSERVATIONS OF A SINGLE UNKNOWN STAR BY A NEW METHOD. By S. E. Ghosh. *London: Empire Survey Review.* Vol. 12, No. 87, 1953. *pages* 17–26

The underlying principle of Mr. Ghosh's method is that by knowing three positions in space of a single star, the plane of the apparent movement of the star in space can be found. The normal to this plane is the axis of the celestial sphere, and this axis points to the pole. The altitude of this axis will give the latitude and its direction will give the azimuth.

The method is theoretically sound, and certainly has the advantage that neither a chronometer nor a knowledge of the position of the star, relative to other stars, is required.

The algebraic solution is neat and gives a direct result, but, from the point of view of the computer, it is rather tedious. If the star is observed more than three times (as would normally be the case in a practical application), then a simpler method of computation would be desirable, since solving the results in groups of three would be unsatisfactory and impractical.

The method requires the simultaneous observation of altitude and azimuth, and errors in the correction for refraction will affect the results since they are unbalanced: in addition, each suitable set of observations must be spread over a long interval of time (8–12 hours), and they cannot be taken more rapidly. If the simultaneous observations are timed, and the star is known, then longitude can also be determined by a direct method, so that a complete and direct solution of the problem is obtained from observations taken to a single known star.

In its present form, the method is unlikely to replace existing methods.

T. L. T.

TRAITÉ DE TECTONIQUE. By J. Goguel. *Paris: Masson et Cie,* 1952. $10\frac{1}{2} \times 7\frac{1}{2}$ *inches;* 383 *pages.* 2400 *fr.*

"La tectonique est la discipline qui envisage l'histoire des déformations qui ont affecté l'écorce terrestre." That is briefly the author's definition of his subject—a subject treated at length and in an interesting manner.

The earlier chapters deal with relatively simple matters, and folds, faults and various types of rock deformation are discussed fully, but not very differently from the accounts given by other authors. Later on interpretations are discussed and analyses made of well-known sections exemplifying folding and thrusting. There is a satisfying chapter entitled "Interprétation dynamique" in which the resistances of various rocks, plasticity and viscosity are treated.

It is, however, in the latter part of the book that the reader is likely to find his greatest interest. This part may be said to begin with a chapter on Isostasy in which the classical views are outlined and discussed. This is followed by a consideration of such factors as the difficulty of dating precisely mountain building movements, the various types of deposits in a geosyncline, and in its turn leads to the treatment of the relation of the orogenic belts to vulcanism and metamorphism. The author also devotes a good deal of space to the Island arcs of the Pacific, and to the oceanic deeps. In this and in subsequent pages the reader misses references to the work of Umbgrove, who although mentioned at least once in the text, is not referred to in the index. His book 'The Pulse of the Earth' covers much of this ground in no little detail.

Monsieur Goguel develops his thesis in a comprehensive manner, and calls attention to the relations existing between mountain chains of different ages, and to the earth movements that have taken place in the more stable parts of the globe. In the final chapter he seeks an explanation of the phenomena discussed in the rest of the book, but he reaches no definite conclusion. Various theories are mentioned, and attention is directed to those based on convection currents in the earth's outer shells. The writings of Jeffreys and Holmes are referred to, but scarcely to the extent one might expect. However, the volume is not primarily concerned with trying to find a full explanation of the features of the earth's surface, but rather with the facts to be explained.

Students and others will find it of considerable value. It is far more than a text-book, and it fulfils very well indeed the significance of its title—Traité de Tectonique. It is, as a book, a typical French production. There are numerous figures, most of which are clear, but some, especially plans or three-dimensional figures, might well have been more adequately drawn. J. A. S.

CARTOGRAPHY

MONUMENTA CARTOGRAPHICA VATICANA: iussu Pii XII P.M. Consilio et opera Procuratorum Bibliothecae Apostolicae Vaticanae. Volumes 1–3. Edited by ROBERTO ALMAGIÀ. *Città del Vaticano*, 1944, 1948, 1952. $16\frac{1}{2} \times 13\frac{1}{2}$ *inches;* vol. 1, 158 *pages* and 56 *plates;* vol. 2, 132 *pages;* 40 *plates;* vol. 3, 92 *pages*, 52 *plates*

The Society has recently received through the generosity of the Vatican Library the three volumes so far published of the 'Monumenta Cartographica Vaticana.' This notable publication sheds much light upon the history of map-making, and particularly upon the contributions to it made by Italians. A number of the maps reproduced have not been published before, and the remainder are sufficiently rare to justify their being made available to students in this convenient form. All the text, with its valuable bibliographical references, is by Professor Roberto Almagià, whose knowledge of the subject is unrivalled.

It is not possible here to comment in detail on the contents, even if that were within the competence of the reviewer, but some indication of its scope may be useful to students.

Volume 1 deals with MS. planispheres, marine charts, and related material,

from the fourteenth to the seventeenth centuries. The early items are of interest as illustrating the evolution of a new type of world map, the earliest examples of which are the work of Fra Paolino Minorita. They are marked by some improvement in the representation of the Persian Gulf and the Indian Ocean; in Africa by the insertion of a river Nile, resembling its delineation by Ptolemy, and some contemporary knowledge of the eastern coast; and an improvement of the Mediterranean outline, probably derived from the early charts. World maps by Petro Vesconte and Marino Sanudo the elder are closely similar, but Professor Almagià awards priority to Fra Paolino, without being able to assert that he was the actual author of this innovation. There is some slight evidence of Arabic influence, but the Professor does not follow up this possible clue. Fra Paolino was also the author of "modern" maps of Italy, in which, similarly, the coasts are outlines from the marine charts with interior details of unknown origin.

A particularly interesting item is a map of most of Europe, the Mediterranean and western Asia, which is clearly closely allied to the well-known world map of Fra Mauro (*c.* 1460), and is therefore attributed to his workshop. In this the reliance of the cartographer upon marine charts is more marked than in the complete world map, and this may reflect the hand of Andrea Bianco, who is known to have worked with Fra Mauro. Professor Almagià puts forward the hypothesis that the Vatican map is anterior to the World Map, and was largely incorporated in the latter. A curious feature is that it purports to show routes It is apparent on inspection that in certain parts of the map these lines cannot represent routes and are possibly boundaries of provinces. In western Europe, *e.g.* in France, the probability seems greater, though the towns are often so misplaced that it is impossible to be certain.

Among later works reproduced, previously undescribed or little known, are a marine atlas of 1562, ascribed to B. Olives, a marine atlas and chart by Diego Homen or from his workshop, and an anonymous chart of the late sixteenth century.

Volume 2 contains engraved maps, unique or rare, mostly of the sixteenth century, which were published separately and not in atlases. These date from the period when Italy was still the centre of cartographical activity in Europe. They are sometimes found as components of the so-called Lafreri atlases (after the Roman publisher, A. Lafreri), but Professor Almagià emphasizes the inappropriateness of this term, in view of the output of his Venetian competitors. In all, some one hundred and eighty maps are described and forty reproduced. Among the unique maps are Gastaldi's map of the Danubian countries, 1546; the map of the Roman Campagna by Eufrosino della Volpaja, 1547; and a world map and maps of the continents by Fausto Rughesi, 1597. Rughesi's world map is of interest as it is drawn on an oblique orthographic projection. Of interest also is a map of Europe, 1572, conjectured to be by Livio Sanuto, which, drawn on a trapezoidal projection, is probably a fragment of a large globe, having a diameter of approximately one metre.

The third volume is devoted entirely to the maps painted on the walls of the Galleria del Belvedere in the Vatican. The forty murals, depicting Italy and its regions, were executed in 1581 for Pope Gregory XIII, under the direction of the Dominican Egnazio Danti, a cosmographer of repute, and a correspondent of Ortelius, who had already done similar work in the Palazzo Vecchio at Florence. The predominant colours are blue for the sea and green for the lower land; highlands and mountains are drawn in oblique perspective with violet or rose tint shading; with the drawings of trees and monuments and the plans of the larger towns, the effect is highly pictorial. It appears that Danti proposed

to engrave the maps from which the murals were made, and to issue them as an atlas of Italy. Had he been able to carry out this project, he would have anticipated Magini and his "Italia" by thirty years. Danti's work did not find favour, for some reason, with his contemporaries. He was criticized, erroneously, for not having used the best material available and for designing the maps on varying scales. Magini was among these critics, although he later made use of Danti's work. Professor Almagià's notes set out the value of the individual maps and the sources on which they are based. The map of the Duchy of Ferrara, for example, is the oldest topographical map of the whole area which has survived; it incorporates original surveys by Danti, and is notable for the attention paid to the hydrography.

These brief notes are sufficient to show that in making available for further study this important corpus of maps, the Vatican authorities and Professor Almagià have greatly extended our knowledge of cartographical history.

G. R. C.

THE LOOK OF MAPS: an examination of cartographic design. By ARTHUR H. ROBINSON. *Madison: University of Wisconsin Press*, 1952. 9½×6 *inches;* ix+105 *pages;* 3 *figures.* $2.75

As Mr. Robinson points out, while the technical aspects of map-making have been developed to an almost revolutionary degree in recent years, little advance has been made in map design. In this respect, most cartographers have demonstrated a traditional conservatism, partly abetted by the seeming indifference of the general public. In these essays, the author seeks to re-open the subject, and, if he arrives at few new or firm conclusions, his attempt at formulating a basis for a thorough examination is timely. Much of the data he employs is drawn from the researches of typographers and advertising designers, the latter perhaps not always sound guides for cartographers. One source of confusion to the reader is that no very clear distinction is made between those elements which can be treated as a problem of design, and the scientific basis of the map, which is not susceptible to this treatment, though the author does recognize, for example, that the choice of projection is not a matter for the designer as such.

The main portion of the book discusses the three factors, lettering, colour and structure or lay-out. In these, he challenges some accepted conventions, *e.g.* that for hypsometric colouring the hues should be used in the order in which they appear in the spectrum; or that maps are made "more visual" through the use of the orthographic projection. His protest against the employment of a great variety of styles of lettering to indicate different types of features is welcome, since in the end this variety defeats its purpose.

If the look of maps is to be improved, what is clearly required is a series of carefully controlled experiments upon which future design may be based. Should Mr. Robinson's essays stimulate this research, they will have performed a very useful service. Those interested in these problems will find the bibliography helpful.

G. R. C.

THE VIENNA–KLOSTERNEUBURG MAP CORPUS OF THE FIFTEENTH CENTURY. By D. B. DURAND. *Leiden: E. J. Brill*, 1952. 9½×6 *inches;* xvi+150 *pages; maps.* 62 *guilders*

Dr. Durand's study of a group of German cartographical manuscripts belonging to the second quarter of the fifteenth century is of wider interest than its title suggests, for it throws light on a period that has been relatively little studied, that between the recovery of Ptolemy's Geography and the

appearance of the first printed *Tabulae Modernae*. It was Dr. George Sarton who suggested to the author the theme of late medieval geography for his doctorate thesis nearly twenty years ago, and a Fellowship from Harvard University enabled him to travel and collect material in Europe, where, too, he was able to contact such scholars as Ernst Zinner. The work was finally completed in 1939, but the war intervened, and publication was delayed until 1952. The main body of material originated among scholars more or less closely connected with the University of Vienna and the nearby monastery of Klosterneuburg, and it is here introduced by a general survey of the background of science in Central Europe at the relevant period. However, the whole text only occupies less than two-thirds of the volume of over 500 pages, as transcripts are given of the more important manuscripts, besides a useful classified bibliography. In addition a collection of twenty-three map plates, mainly facsimiles, but including a few reconstructions by the author, fills a pocket in the end cover. Thus the student (especially the student of the History of Science) is well provided for, and can form his own conclusions. Dr. Durand was trained in the school of History and not in that of Geography, so that from time to time he reveals a certain unfamiliarity with maps, and a regrettable indifference to the astronomical and geometrical instruments by means of which the data for drawing maps are assembled. To set against this is however the meticulous care with which he handles and records all documentary source material and all secondary material used.

The new corpus of cartographical manuscripts includes a number of maps and sketch-maps (which are reproduced) and also several long lists of actual and "pseudo" latitudes and longitudes, the data from which maps could be drawn on the model of those of Ptolemy, or alternatively the circular *mappa mundi* could be given a geometrical framework. The latter effort reveals a very curious and forgotten blind-alley followed by some of the cartographers of this transition period; an attempt to transform the *mappa mundi* into an equidistant azimuthal projection of a hemisphere centred about Jerusalem or some other selected point. The circles of latitude were circles round this centre, the lines of longitude stretched to the circumference circle, which was divided like the ecliptic into twelve "signs" of 30 degrees each. Dr. Durand constructed a map from the hundreds of entries in one such table, and it seems clear that the figures had been obtained by measuring directions and distances on an existing circular map, one not unlike Andreas Walsperger's map of 1448 which is also reproduced. Lists of true latitudes and longitudes go back, of course, to the earliest Toletan Tables or Ephemerides of the Arab astronomers. These were necessary for "rectifying" the stellar positions for the place of observation when it was other than Toledo or wherever the Tables were drawn. Roger Bacon deplored the lack of western names in these tables, the wider usefulness of which he explained in his *Opus Majus*, and in particular their usefulness in drawing a map on a rectangular network, such as he seems to have himself designed, drawn and presented to the Pope. No explanation appears as to why no other similar maps were attempted until the fifteenth century, by which date the lists had been greatly extended, as exemplified by several reproduced by Dr. Durand. Even so, of course, the Tables could only locate major cities, and the cartographer would have to depend mainly upon itineraries, sketches and older maps. Once a map was drawn, it could be reduced to a direction and distance table from which it could be reproduced at will, and this probably was the reason for the construction of these tables during the period just prior to the introduction of engraving, which rendered them unnecessary. Many other interesting points are discussed or arise incidentally in this book, as for example

the early use of a decimal notation, the calculation of distances between places whose latitudes and longitudes are known, the problems of Nicholas à Cusa's map, the work of Nicholas Germanus—to name only a few of them. We are introduced, too, to forerunners of Georg Peurbach and Regiomontanus, at whom we had scarcely glanced in our preoccupation with the opening of the great discoveries by sea and the consequent development of the sea-chart. The astrolabe and quadrant, the Albion, chilindre, torquetum, equatorie and many more were instruments known to Abbot Engelhard of Reichenbach, but he added to them one of his own design, while the description and use of each and all of them was written by his contemporary, Magister Reinhard. From Reinhard it appears that the Abbot's invention was of just such a type as Geoffrey Chaucer's—a device for displaying the planetary motions through their cycles and epicycles as set out in Ptolemy's Almagest. Only a generation, in fact, separated the lives of the Father of English Poetry and this German abbot-astronomer, who died before 1444. E. G. R. T.

HISTORICAL GEOGRAPHY

GEOGRAPHISCHE GRUNDLAGEN DER GESCHICHTE. By Hugo Hassinger. (Geschichte führender Völker.) *Freiburg: Verlag Herder*, 1953. 2nd ed. 9×6 *inches;* xii+390 *pages; sketch-maps. D.M.*22

This work, first published in 1930 and now considerably enlarged, is designed as a geographical introduction to the series "Geschichte führender Völker." It is therefore primarily directed to historians. The theme is the spread of cultures over the earth and the formation of cultural landscapes. Professor Hassinger is careful to disclaim a rigid determinism—cultures are a compound of "Geist und Stoff," and the historical geographer must take into account the geographical environment, the cultural stage, and historical influences. At any given moment, a cultural unit is offered a choice of possibilities, but since these are limited by geographical factors, environment exerts a continuing and considerable influence on historical development. Considerable weight is given to the role of climate, and particularly to its fluctuations; the migrations of peoples which undermined the Roman empire are attributed mainly to climatic deterioration. A useful distinction is made between area of movement and the lesser area of settlement, and, within the latter, especially favoured regions which have become foci of human activities. These foci are found, first, in "oases" in tropical highlands or sub-tropical river basins, and later, in islands and neighbouring portions of accidented coasts. He stresses the importance of exchange between the peoples of the former and of the steppe and desert. In the case of the islands, the role of the steppes is assumed by the sea.

On this basis, the history of the old world, the Mediterranean basin, western Europe and its overseas expansion, and the rise of the world powers of to-day is described. The space available does not permit of great detail, and in some instances the sections are too brief to be of great value, but as a whole the book presents a unified and coherent account.

In this edition the author has given more space to the findings of archaeology and prehistory; but some of his conclusions, *e.g.* of the influence of eastern Asian cultures on those of America, and of the extent of European contacts with eastern America before Columbus, seem to exceed what would be generally accepted. G. R. C.

GEOGRAPHICAL HISTORY IN GREEK LANDS. By J. L. Myres. *Oxford: Clarendon Press*, 1953. 9×5½ *inches;* x+381 *pages; sketch-maps and illustrations.* 35*s*

The twelve lectures here collected span what might be called Sir John Myres's middle period, from 1910 to 1941. (The "select list" of his published works, which is appended, runs from 1891 to 1952; and 1953 has already witnessed the publication of two books and several reviews and articles.) Earliest of these papers is a public lecture delivered at Oxford in May, 1910, to an audience chiefly of men beginning "Greats." It is entitled "The value of Ancient History," but contains also most stimulating advice on how to study history and, by implication, on how to teach it, which has lost none of its point to-day.

Subsequent titles include "Greek lands and the Greek people" (the inaugural of November 1910); "The geographical study of Greek and Roman culture"; "The geographical distribution of the Greek city-states"; "The geographical aspect of Greek colonization," and "The causes of rise and fall in the population of the Ancient World" (Eugenics Society, 1915). Among topics discussed are the bearing of a high infant death rate on the tendency of a region to "select" physical types from among a mixed population, and on how the Jews inherited the earth by *not* practising infanticide. The book concludes with papers on "The position of the Greek kingdom in the Eastern Mediterranean" (1941), "The Marmara region," a historical sketch (1923), "The islands of the Aegean" (1941) and, in more detail, "The Dodecanese" (1920), brought up to date with many references to literature of 1945 to 1950, and still astonishingly fresh.

No book of reprinted lectures on the human sciences, indeed, was ever less "dated"; a state of affairs due, no doubt, to ruthless selection, and certainly also to incisive editing. Remarks on "The next phase in geographical teaching" are omitted from a British Association address of 1928 as having been "overtaken by events." One could wish that the warnings of 1910 on the teaching of long term human history showed any sign of being so overtaken. Unfortunately it remains as true as ever that, with the reduction of time allotted in education to Greek and Latin, it is precisely the historical, social and political lessons which can be learned through these languages which are now reached by very few. Too many "pure" scholars continue with unabashed smugness to regard Latin grammar as "a good foundation" for an edifice that few of their pupils will ever begin to build. It must be hoped that geographical history may be able to lay a better foundation for the understanding, by the intelligent citizen of tomorrow who is not a professional scholar, both of Greek and of Roman and Hebrew civilization and translated literature, now that the former position has been so fantastically betrayed by its defenders. A. R. B.

BIOGRAPHY

AMUNDSEN. By Bellamy Partridge. *London: Robert Hale*, 1953. 8½×3½ *inches;* xv+206 *pages; maps and illustrations.* 16*s*

Mr. Partridge has not aimed at writing a biography of Roald Amundsen, but rather at giving a condensed account of the Norwegian's many expeditions with emphasis on their more adventurous aspects. No explorer has a longer record of expeditions to his credit, and nearly all of them successful. Amundsen was a careful planner and paid particular attention to his means of transport. In his greatest triumph, the attainment of the South Pole, 1860 miles in ninety-nine days there and back, he attributed, and rightly, his success to the use of plenty of dogs. He was accustomed to dogs and knew how to handle them, and

personally considered that without them he could never have attained his objective and returned. In his voyages through the North-east and North-west Passages he had the advantage of ships, *Fram* and *Maud*, built for the purpose, shallow draught and broad in the beam, and admirably suited to be handled by small crews. As soon as air transport became practical, Amundsen turned to the airship and aeroplane. This seemed to him a more practical way than sledging of reaching the North Pole. He thus came in contact with the Italian aviator, Nobile, with whom in later years he had a strong difference of opinion. This, however, did not deter Amundsen from giving his life in a courageous attempt to rescue Nobile some years later.

Most of the matter of this book has appeared in English already. Perhaps an exception is the account of the North-east Passage, but it all bears retelling.

Amundsen was a great explorer, but to hail him or any other as the greatest is surely invidious. The book is commendably free from errors, but a continual source of irritation is the common mistake of spelling Spitsbergen incorrectly. It is time that publishers realized this. There are several useful sketch-maps.

R. N. R. B.

FRANCIS YOUNGHUSBAND: explorer and mystic. By GEORGE SEAVER. *London: John Murray*, 1952. 8½×5½ *inches;* xi+391 *pages; maps and illustrations.* 25*s*

Sir Francis Younghusband [1] has sometimes been called "the father of Himalayan Exploration," and it is in that sense that most of us who knew him in the Royal Geographical Society, as President from 1919 to 1922 and in his later years, regarded him. For not only had his crossing of Asia from Peking to India, including the Muztagh pass, when a young subaltern in 1887, and his subsequent travels in the Karakoram, on the Pamirs and in Chitral captured the imagination of his countrymen at a time when there were no maps of these regions—as did his leadership of the Tibet Mission in 1904—but he was also the inspiration behind all the early projects for the conquest of Everest, and Chairman of the first Mount Everest Committee.

The story of his early adventures is well told in this fine biography, though re-telling can never entirely recapture the spell cast by Younghusband's own words in 'The Heart of a Continent.' That of the Tibet Mission and its aftermath occupies three chapters and is extremely well-balanced. Younghusband was the life and soul of this difficult mission, the admired of all who served under him, and the pattern of what a leader should be: thorough and unhurried in his preparations, eager to seize the fleeting chance, patient, unruffled and audacious in the face of personal danger, and unafraid to take the responsibility of departing from the letter of his instructions. "The Aftermath" (Chapter 18) is indeed better told here than in any of Younghusband's own writings, because of his own unwillingness to discredit the then Secretary of State for India, who utterly failed to understand the problem of Tibet from beginning to end or to appreciate that in Younghusband he had a deputy supreme in interpreting the Eastern mind.

[1] An obituary notice of Sir Francis Younghusband was published in *Geogr. J.* vol. 100, Sept. (1942), 131–7, and included tributes from three officers who served under him on the Tibet Mission. In that account four minor misprints occurred:

Page 131, line 4. Younghusband was commissioned in 1882, not 1892.

Page 131, line 12 from bottom. The date of Younghusband's departure from Peking was 4 April 1887, not 1886. (He was in Manchuria during most of 1886).

Page 135, line 9. For C. E. D. Ryder read C. H. D. Ryder.

Page 136, line 13. For Chumli read Chumbi.

Younghusband came from a famous fighting family: his father, his father's four brothers, and his own two brothers were all in the army; all served in India; five of these rose to be generals and the other two were killed on active service in the field. He himself was commissioned in the King's Dragoon Guards, but he was never absolutely happy as a regimental officer. The explanation is here shown to be in the restless conflict of his emotions as a young man and in the mystical character of his being. The biographer admirably traces this conflict throughout his life and shows how his experiences reacted on his enthusiastic and resolute but kindly character and how certain specific experiences influenced his outlook and his interests in later years, such as his devotional enthusiasm for the Mount Everest adventure and his work for religious toleration, which culminated in the founding by him of the World Congress of Faiths in 1936. The frontispiece is from the fine portrait painted by Harold Speed in the following year. K. M.

SOME RECENT TRAVEL BOOKS

SOME AFRICAN MILESTONES. By H. F. VARIAN. *Wheatley, Oxford: George Ronald,* 1953. $5\frac{3}{4}\times9$ *inches;* xv+256 *pages; appendices, end-papers map and illustrations.* 18*s* 6*d*

THE SUDDEN VIEW: a Mexican Journey. By SYBILLE BEDFORD. *London: Victor Gollancz Ltd.,* 1953. $5\frac{1}{2}\times9$ *inches;* 288 pages. 18*s*

BRITTANY ROUNDABOUT. By GARRY HOGG. *London: Museum Press, Ltd.,* 1953. $5\frac{3}{4}\times9$ *inches;* 223 *pages; map and illustrations.* 15*s*

Unlike the others here considered, H. F. Varian's book largely concerns work done. The author, an engineer, has spent most of his life, from the turn of the century onwards, following the great empire-builder Rhodes, in opening up Africa, mainly engaged on the Pioneer Railways, in the Rhodesias, Angola and elsewhere. His modestly written book, not without its vein of dry humour, has value as a document (specially interesting are the account and photographs of the building of the bridge over the Victoria Falls) and contains many reminiscences of a land now much transformed, of dealings with natives and encounters with big game.

From a literary point of view Mrs. Bedford's fascinating book on Mexico is very easily the outstanding member of this trio. This first-rate work is the outcome of a stay of more than a year in that land of beauty and brutality which so attracts and repels, constantly amazing all Europeans. Mrs. Bedford is a cultured, objective and highly perceptive traveller. In Mexico City for instance she notes a collection of idyllic landscapes and pictures of birds, butterflies and flowers which is followed by one showing an Indian boy clutching "a neatly dressed and bonnetted baby skeleton." This book has many sides, among them the picture of a delightful life near Lake Chapala, the tale of the ill-fated Habsburg Emperor of Mexico, Maximilian, and the clash between the relics of Aztec civilization and Spanish Catholics.

Garry Hogg's trip to Brittany with his wife is a far more modest journey. To travel with this enthusiastic but candid pair is certainly a pleasure. They walk (or hitch-hike) round the coast from the renascent St. Malo, watching a regatta by night at Binic, on to the impressive rocks of Ploumanac'h, through Morlaix and Brest to the northern side of Douarnenez Bay, where, according to legend, the drowned city of Is lies buried, across this bay in a stormy passage vividly described, on to see the coifs of Concarneau and from Vannes back across country to Mont St. Michel where they enjoy Mère Poulard's famous omelets before coming to St. Malo again. L. R. W.

Keystone Agency Ltd.

Keystone Agency Ltd.

The arrival of the Mount Everest Expedition at London Airport, 3 July 1953. Left: Sir Edmund Hillary, Sir John Hunt (with flag), and Tensing Norkey Sherpa, G.M. Right: Tensing, with wife and two daughters

Fox Photos Ltd.

The Mount Everest Expedition at London Airport, 3 July 1953

At the Society's House. Second from left, Mr. J. M. Wordie (President R.G.S.); fourth from left, Sir Edwin Herbert (President Alpine Club and Chairman of Himalayan Committee)

THE SOCIETY'S NEWS

THE NEW OFFICERS AND COUNCIL OF THE SOCIETY

The following new appointments were among the elections made at the Annual General Meeting on June 22. Marshal of the Royal Air Force Sir John Slessor, formerly a Trustee, and Sir George Binney become Vice-presidents of the Society. Mr. Leonard Brooks becomes Hon. Treasurer, his place as Hon. Secretary being taken by Dr. E. W. H. Briault. Professor Frank Debenham, formerly a Vice-president, is now one of the Trustees. Seven new Members of Council were elected. Sir Miles Clifford, K.B.E., Governor of the Falkland Islands since 1946, has made several journeys in Antarctica. Professor K. C. Edwards, Professor of Geography in the University of Nottingham since 1948, acted as head of the Department of Geography at University College, Auckland, in 1951. Dr. H. F. P. Herdman, one of the original staff of the Discovery Committee, sailed in R.R.S. *Discovery* in 1925–28, and has made four voyages in *Discovery II*; he is an authority on the natural history of sea-ice. Lord Nathan of Churt, Minister of Civil Aviation from 1946 to 1948, is a Member of the General Medical Council. Baroness Ravensdale, eldest daughter of Lord Curzon, was a Member of Council from 1938 to 1943. Mr. Eric Shipton, Patron's Medallist for 1938, led the Mount Everest Reconnaissance Expedition in 1951 and the British Himalayan Expedition of 1952. Professor E. H. Thompson, formerly an officer of the Ordnance Survey, is Professor of Surveying and Photogrammetry at University College, London.

ALFRED RUSSEL WALLACE

Delegates of various learned Societies including the Royal Geographical Society, represented by Dr. Edward Hindle, F.R.S., Honorary Secretary, were present on 1 July 1953, at the unveiling of a Memorial Plaque to Alfred Russel Wallace, O.M., F.R.S., on the house he occupied during his last years—"The Orchard," Wallace Road, Broadstone. The ceremony was performed by the Mayor of Poole, following an address by Lieut.-Colonel Seymour Sewell, F.R.S., President of the Linnean Society. Afterwards the party proceeded to Broadstone Cemetery where a wreath was laid on Wallace's tomb.

A. R. Wallace was a Fellow of the Society for fifty-nine years, from 1854 to 1913, and was awarded the Founder's Medal in 1892 with the citation—"The well-known naturalist and traveller in the tropics of both hemispheres, and co-discoverer with Charles Darwin of the Theory of Natural Selection, in recognition of the high geographical value of his great works 'The geographical distribution of animals,' 'Island Life,' and 'The Malay Archipelago.'"

GEOGRAPHICAL ESSAY AWARD, AND NEW CONDITIONS

The prize for 1953 has been awarded to R. D. P. Smith, St. Catherine's College, Cambridge, for an essay on "Urban geography in eastern England." On the recommendation of the Education Committee, the Council has decided that in future the prize should be offered for "a geographical essay, not exceeding 5,000 words in length, including sketch maps and diagrams." This replaces the announcement made in the first three lines of the paragraph on page 242 of the *Geographical Journal* for June, 1953, but the remaining conditions are unchanged.

THE RECORD

CONTRIBUTORS TO THIS ISSUE OF THE *JOURNAL*

Dr. Edward Wyss-Dunant is a well-known Swiss climber and traveller; in 1938 he made the ascent of Mount Forel in Greenland, and in 1952 led the Swiss expedition to Mount Everest. *Professor J. A. Steers*, professor of geography at Cambridge, has specialized in the study of coastal features and coastal erosion. *Dr. Hartmut Valentin*, an assistant lecturer in the Geography Department of the Free University of West Berlin, was awarded a British Council research scholarship in 1951, and is at present working with Professor Steers at Cambridge. *Lord Rennell of Rodd*, a Trustee of the Society, was awarded the Founder's Medal in 1929 for his journeys in Aïr, and was President of the Society from 1945 to 1948. *Dr. A. C. Allison*, an anthropologist, was a member of the Oxford University Expedition to Norwegian Lapland in 1950. *Mr. C. Warren Bonython*, a member of the staff of I.C.I. Alkali (Australia) Proprietary, Ltd. at Osborne South Australia, led expeditions to Lake Eyre in the Australian interior in 1951, and *Mr. B. Mason* is State Climatologist for South Australia at the Adelaide Weather Bureau. *Dr. D. Trevor Williams*, formerly lecturer in geography at Swansea, is now Planning Adviser in the Welsh Office of the Ministry of Housing and Local Government.

UNIVERSITY NEWS

APPOINTMENTS

The following appointments have recently been announced. Dr. Ronald Miller, lecturer in geography in the Department of Geography, Edinburgh University, is to succeed Professor A. Stevens, who is retiring from the chair of geography in the University of Glasgow. Professor R. F. E. W. Peel, professor of geography, Leeds University, has been appointed head of the department in succession to Professor A. V. Williamson, who has resigned.

UNIVERSITY COLLEGE, LONDON

The fiftieth year of the Department of Geography was celebrated on 16 May 1953. It is true that a Chair of Geography was held by Captain Maconochie, R.N., Secretary of the Royal Geographical Society as early as 1834–36 (*Geogr. J.* 81, 536–8), but there was no further development until the appointment of L. W. Lyde to a Chair of Economic Geography in 1903. At the celebration this year, the College gave a tea party for 220 people, mainly former students of the Department, and happily very representative of its different years. This was followed by a symposium of talks given by five former members of the Department—Dr. Alice Garnett, Professor S. H. Beaver, C. S. Smyth, Professor R. Ogilvie Buchanan and A. E. Smailes. In the evening there was a dinner for 135 (all the Refectory can accommodate); the toast of the College was proposed by Dr. Garnett and replied to by the Provost; the toast of the Department was proposed by Professor S. W. Wooldridge and replied to by Professor H. C. Darby. Many greetings were received from graduates of the Department now widely scattered over the world. H. C. D.

TWO MAP EXHIBITIONS

That two comprehensive exhibitions illustrating the history of cartography should have been on view in London within a few weeks of each other is sufficiently novel to deserve record, and testifies to the growing interest in the

subject. As part of the bicentenary celebrations of the British Museum, a large number of maps, charts, and early instruments, mainly from the Map Room and the Department of Manuscripts, were shown during April in the King's Library. The exhibits included examples of primitive and historical maps, but the main theme was the development of cartography from the fifteenth to the eighteenth century, the principal groups being charts and maps of the great discoveries, the evolution of the marine chart down to the era of Captain Cook, and early regional maps. Some interesting special maps were also shown. Though this was the largest exhibition of maps arranged by the British Museum, it was by no means representative of all the Museum's cartographical collections. It afforded a unique opportunity to examine many rarities arranged in a logical relationship, and it is to be regretted that it was open only for so short a time, not least in view of the care and time expended on its arrangement and annotation. Provision for a permanent display of maps would add much to the value and usefulness of this great collection.

In June and July another comprehensive exhibition was on view at the Royal Institute of Chartered Surveyors. Entitled "Five centuries of maps and map-making," this was a remarkable collection of maps, plans, books, atlases, and instruments dealing with the technique not only of land surveying, which was naturally well represented, but with that of almost every aspect of earth-measurement. One thousand items were shown, of which two-thirds were lent by Mr. Cyril Kenney, who has been an assiduous collector for many years. Among the manuscripts were the 'Survey of estates in the parish of Sittingbourne' made by Christopher Saxton in 1590, and several items associated with Warren Hastings and with Napoleon's Italian campaigns. Other sections included books dealing with the drawing, engraving and colouring of maps, road books, and early geodetic treatises. The practical uses of maps and plans in the modern world were demonstrated by exhibits covering the activities of government departments and planning authorities. A useful printed catalogue is available, price 2*s*. G. R. C.

NOTES ON SAND DUNES AND ARTESIAN WATER IN EGYPT AND THE SUDAN

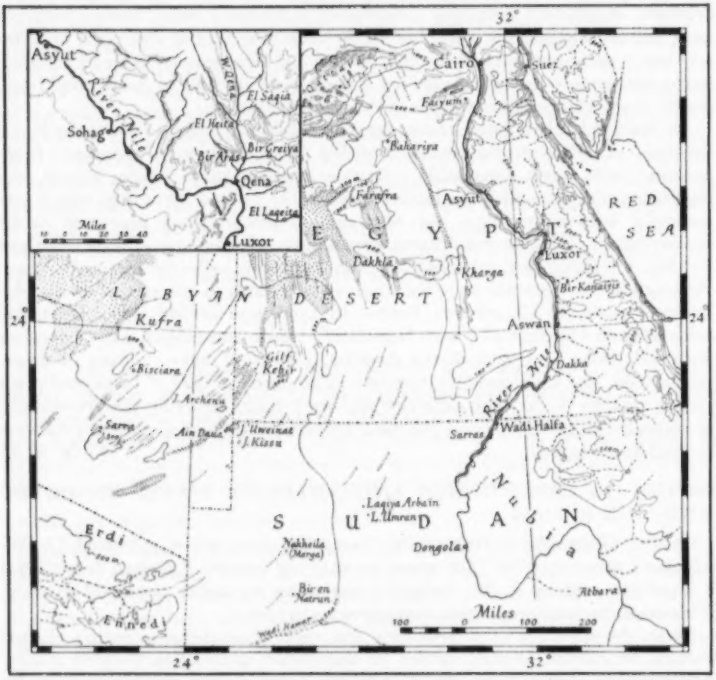
In the *Geographical Journal* for December 1952 there appeared G. W. Murray's paper entitled "The water beneath the western Egyptian desert" and a letter (p. 518) by A. W. Ireland referring to an earlier paper by Murray. Perhaps some further remarks may serve a purpose.

First, the question of distribution and type of sand-dunes in the eastern Sahara, or Libyan Desert, cannot be considered in isolation because similar problems are evident from the Nile to the Atlantic. The alignment of major dune-belts is superbly displayed on Sheets 1 and 2 of the 'Carte Géologique Internationale de l'Afrique' (1 : 5M). In the east, north of about 23° N. the alignment is about NNW–SSE; in Libya [1] and the French Sahara it is about north–south as far south as, say, 28° N. But across the whole width of the continent south of those latitudes the alignment is progressively turned until in the south it is about ENE–WSW. It may well be that the change in direction is related to westerly deflection of the north winds, akin to that of the Atlantic trade winds, or to the northern limits of the summer southerly winds, or to both; but it is certainly not a simple problem, as study of Plates 3–6 in Hurst and Phillips' 'The Nile Basin,' vol. I, for example, will show. So far as the north-eastern Libyan *seif* dunes are concerned the condition has persisted probably

[1] See map facing p. 186 in the *Journal* for June 1953.

throughout their constitutional history which, for the Abu Moharik belt, John Ball estimated to be about 35,000 years.[1]

It is true also that the southern fringes of the Sahara contain both old "dead" sand-dunes and red sand, but the alignment concerns "living," moving sands both yellow (or white) and red. So far as the country south of a line from 'Uweinat to Qena is concerned (mentioned by both Murray and Ireland), the deflection of dune alignment across the continent would therefore indicate the non-arenaceous Cretaceous and Tertiary rocks west of the Nile valley in Nubia as regions traversed by deflected northerly winds which elsewhere create, or



have created, sand-dunes. Not until those winds had traversed considerable areas of sandy Nubian beds might they be capable of piling up major sand accumulations. The paucity of dunes and prominence of isolated barchans in some parts of the north-western Sudan, contrasting with the great accumulations east, west and south of 'Uweinat, in northern Kordofan, and from northern Ennedi to Tibesti may thus be due to combinations of geology and westerly deflection of northerly winds in the broad expanses of the Sahara of which the alignment of the dunes themselves is the concrete evidence. How far southerly or westerly winds contribute sand is perhaps conjectural, but detail seen in the field leaves me unconvinced on the point.

Secondly, Ireland mentions in his letter the question of rainfall at notoriously

[1] *Geogr. J.* 70 (1927) 213–4.

arid Wadi Halfa; indeed the installation of a rain gauge has achieved notable results. He might have referred to a combination of the summer southerly winds and occasional torrential rain in that region which brought distress to the troops and destruction to the railway during the campaign of the cataracts in 1896. Sir Winston Churchill has described it vividly.[1] Southerly storms of rain and sand occurred over three days and were responsible for the miseries suffered by Lewis's Brigade in what became known as "The Death March." On August 26 nearly fourteen miles of track south of Sarras were destroyed, principally because culverts had been considered unnecessary; the line was working again in a few days. About twenty-five years ago one saw gaps in embankments and rails suspended over torrent beds resulting from floods since the line was dismantled in 1905.[2] No doubt further destruction has taken place subsequently. In 1932 rain runnels attracted my attention in the desert far to the west, in these latitudes.

In the Halfa–Dongola country, then, it may be assumed that some rain enters the rocks over a period of years and forms hanging water-tables.[3], but the contribution to sub-surface static water is of slight significance around Wadi Halfa.[4] From Dongola south-westward to Kordofan the significant intake of surface water from annual rains into the solid rock (mostly Nubian Series) increases with decrease of latitude and increasing altitude until the conditions of the Wadi Hawa (now spelt Hawar) are attained. Here, and in the highlands north-westward to Tibesti, lie the intake regions of the static water known in the eastern Libyan Desert. There is a graduated distinction of latitude and altitude between regions where summer southerlies bring rain, where they have got unusually far north and bring rain within living memory, such as 'Uweinat and Wadi Halfa, and country north of the exceptional limit which seems to be rainless in more than a biological sense, for example the latitude of Kharga.

Thirdly, other circumstances arise east of the Nile, where the nearer the plains approach the Red Sea Hills the greater the possibility of occasional rainstorms. Moreover in the north rain may come in winter from Mediterranean storms.[5] So from Dongola–Wadi Halfa to the Red Sea Hills of the northern Sudan and Egypt rain may at some time deluge a district now, and in the recent geological past running water has moved vast quantities of debris from the Hills toward the Nile.

Murray's plotting of the 100-metre static water contour on the east side of the Nile northward from near Dakka and passing west of Lageita Wells thus seems to be a pioneer step toward the recognition of the Red Sea Hills as a source of "fossil water" analogous to the Ennedi–Tibesti highlands. No doubt his termination of the contour near Lageita Wells is intentionally conservative, for it would in fact pass northward very close to the waterhole of Bir Aras, in the lower Wadi Qena. Farther up that wadi lie the Roman stations of El Heita and El Saqia, where water is not available to-day, and east of Bir Aras lies Bir Greiya.

El Heita and Bir Greiya lie close to the 200-metre topographic contour, and one may perhaps assume a water-level within some proximity to it; El Saqia is at about 250 metres. In a letter replying to a copy of these notes Mr. Murray

[1] 'The River War,' vol. I, pp. 250–3 and 281–2.

[2] "The Anglo-Egyptian Sudan from within,' London, 1935, p. 249, gives this date.

[3] G. W. Grabham, "Water supplies in the Anglo-Egyptian Sudan," *Bulletin* No. 2, Khartoum, 1934, pp. 14–16).

[4] See Murray's letter p. 124 in the *Journal* for March 1953.

[5] For example, the paths of depressions shown in Plate VII and letterpress in W. F. Hume's 'Geology of Egypt,' vol. I.

says that a bore reached a little brackish water at 70 metres, in the Nubian rocks at El Saqia, which was sited too far away to tap any subterranean flow down the Wadi Qena. It is conceivable therefore that a 100-metre static water contour may run northward up the Wadi Qena and be matched by higher water-levels nearer the Red Sea Hills (recalling Bir Kanayis and Lageita of Murray's recent paper).[1]

Some such construction is indeed predicted by Murray's re-plotting of Ball's 50-metre static water contour to run east of the Nile from a point near Asyut to Helwan near Cairo. The water-levels mentioned here are independent of natural cisterns in impermeable rocks and of saturated loose rocks debris in the Red Sea Hills and in the eastern limestone plateau. I suggest that they are also independent of the old gravels of the Wadi Qena basin, because my impression of the wadi, in which I worked many years ago, is that essentially it is filled with Pliocene conglomerates, sand and clays—from which, ultimately, the water of Bir Aras springs: the gravels, though of vast extent and substantial thickness, are superficial.

Moreover Cretaceous and Nubian rocks, much disturbed, occur at El Saqia; the latter may be seen in the plains between El Saqia and the Red Sea Hills, and immediately east of Bir Greiya. K. S. S.

THE CONFERENCE OF GERMAN GEOGRAPHERS AT ESSEN[2]

Conferences of German geographers have been held at irregular intervals since 1881. The conference at Essen, the third since the last war, was attended by about 600 persons—university and other professional geographers, among them a small number from eastern Germany, geography teachers and students, and, in addition, guests from Austria, Switzerland, the United Kingdom and the United States. The conference was officially opened on the morning of May 26 by the Chairman, Professor H. Lehmann. Short greeting addresses by the town mayor and other representatives of the administration were followed by the *Festvortrag* by Dr. H. Spethmann who sketched a picture of the development of the Ruhr region. The rest of the day was devoted to reports by German geographers of their recent research overseas: Professor H. Mortensen, based on his studies in Texas and New Mexico, developed new ideas as regards scarp formation; Professor A. Kolb communicated results of glaciological studies in New Zealand; Professor H. Lehmann spoke about a specifically tropical type of Karst, the *Kegelkarst* (Karst cones), using as an example the West Indies. Dr. H. Abel reported results of his geomorphological investigations in the Kaoko Veld in south-west Africa. Two papers, by Dr. H. Mensching and Dr. K. Wiche, were devoted to geomorphological studies in the middle and high Atlas Mountains, respectively. Professor J. Schmithüsen presented the first detailed map of the vegetation regions of Chile. Professor C. Schott painted an impressive picture of the Canadian Prairie Provinces and their problems, and Professor H. Wilhelmy gave a regional account of the Pacific coastal plain of Colombia. Only some of the next day's papers can be mentioned here, Professor Pfeifer's, for instance, on the human geographic distinctiveness of the South-east United States. On specifically European subjects, mention must be made of the excellent paper by Professor W. Müller-Wille on genetic settlement types of rural north-west Germany, and others by Dr. Gabriele Schwarz on the enclosure in Lower Saxony; Dr. F. Monheim on

[1] *Geogr. J.*, December 1952, pp. 445, 452.

[2] For proceeeings of the Conference, see the series "Verhandlungen des Deutchen Geographentages," Bd. 29, Bundesamt dur Landeskunde Remagen/Rh.

altitudinal limits of field systems in the Alps; Dr. H. Uhlig on the use of air photographs as tools for research in historical geography, illustrated by the example of north-east England; and Dr. H. Paschinger on the economic geographical problems of Trieste.

On May 27 there were two public lectures, one by Professor H. Schlenger on the recent gigantic industrial development of the Upper-Silesian–Moravian region, and the other by Professor Th. Kraus on the heavy iron and steel industrial regions of the United States.

The morning of May 28 was occupied by excursions through Essen and the neighbourhood for which the town council provided free buses. During the earlier part of the afternoon five papers were read dealing with geomorphological topics. Professor E. Neef spoke about slope development in crystalline uplands; Dr. H. Müller presented and discussed a map of the scarps of the Westphalian (Münster) "Bay"; and, of particular interest to British geographers, there was a paper by Dr. H. Valentin on recent vertical movements of the British Isles and the level of the surrounding seas. One might have wished for more opportunities for informal meetings and discussions, but on the whole it can justly be said that the conference was very successful and that it gave an impressive demonstration of the great activity of German geographers. K. A. S.

LAKE SOUNDING RECORDS

In connection with the proposal of Mr. Dybeck to collect records of lake soundings, which was reported in the June number of the *Journal*, it may be of interest to list the records held by the Ordnance Survey and used for the insertion of lake bed contours on Ordnance Survey maps. These records refer to surveys carried out by other institutions and individuals as it has always been the policy of the Ordnance Survey not to do bathymetric surveys. In an old Ordnance Survey file there is correspondence from the Treasury dated 1883 which clearly states this policy and it has been confirmed by various Departmental Committees since that time. The surveys used by the Ordnance Survey before 1934 are described on pages 44 and 45 of "The National Plans" by Brigadier H. St. J. L. Winterbotham.

In the English Lake District, the ten largest lakes were surveyed in 1893/94 by Dr. H. R. Mill and Edward Heawood, M.A., and this survey is referred to in the *Geogr. J.* Vol. VI of 1895 (*vide* "The National Plans," p. 44). Tracings at 6 inches to 1 mile scale made from this survey are held by the Ordnance Survey. They cover nine of the lakes but the tracings of Haweswater are missing and it is possible that they were destroyed by enemy action. The tracings show soundings, depth contours below water-level and height contours of the lake bed above Ordnance datum. The height contours, at 25 ft. V.I., were inserted on the 2nd edition of the 6-inch map and record copies of this edition are held by the Ordnance Survey, including the sheet showing the contours of Haweswater. The contours were omitted from subsequent editions and although Winterbotham in "The National Plans" said they would be reinserted, this had not yet been done. They do appear however on the 1-Inch New Popular Edition with the heights expressed as depths below the surface.

In Scotland, most of the larger freshwater lochs were surveyed between 1902 and 1909 by the Pullar Trust. This survey is described in "Bathymetrical Survey of the Freshwater Lochs of Scotland" by Sir John Murray and Lawrence Pullar, published in six volumes. The original 6-inch scale tracings of contours from this survey are held by the Ordnance Survey and the old file mentioned above contains the whole correspondence between the Ordnance Survey and Sir John Murray regarding the survey. The contours are referred to water-level

and the water-level at the time was not always connected with Ordnance Survey levels. This is explained in the file and mentioned by Winterbotham in "The National Plans." The contour interval varies for different lochs. These contours appear on some of the 1-inch scale sheets of Scotland and a footnote acknowledges the source of the information.

No other original survey material regarding Lake Soundings has been traced among Ordnance Survey records, but Winterbotham mentions surveys of the English Lakes by the Geological Survey, of Grassmere by a Mr. Green and of Welsh Lakes by a Mr. Kingsley. In addition, Windermere was surveyed by the Hydrographer of the Admiralty in 1937 and it is known that copies of the results were sent to the Ordnance Survey, but it is assumed that these were destroyed when the Ordnance Survey office at Southampton was bombed during the war.

CORRECTIONS

We have received some corrections to the Discussion which followed the reading of Professor Cotton's paper on 10 November 1952. Dr. F. Dixey's remarks should read: para. 2, line 4: "If a mature surface is folded in anticlinal form, it would be extremely difficult to distinguish the various forms." Para. 3, line 3: "fault-line scarp" for "high-line scarp", then "In areas where there are sediments faulted down against older rocks, as in East Africa in Karroo fault-troughs or along the Nandi scarp, if the cycle that produced the scarp by erosion of the sediments is sufficiently prolonged. . . ." Para 3, line 12: "This lower surface is now in course of dissection, and at no distant time geologically one might expect that a new fault-line would develop along the fault itself, so that there would be two fault-line scarps giving rise to a two-cycle fault-line scarp." (*Geogr. J.* 119 (1953) 220-1.

Mr. H. S W. Edwardes has pointed out an error in the note "From the *Journal* a hundred years ago" on p. 223 of the June *Journal*. The Quorra is the Niger, not the Benue. The sentence should read "the river referred to as 'the *true* Niger' is now known as the Benue."

OBITUARY

DR. ROBERT LLOYD PRAEGER

Dr. Praeger died in Belfast on 5 May 1953, aged eighty-seven. Born in Belfast of Dutch stock, he always spoke of himself as an Irishman and almost the whole of his working life was spent in Dublin, where he was Librarian of the National Library. To him, Irish politics mattered little: science and literature had no frontiers. His name will be familiar to many readers from the dedication in W. B. Wright's 'Quaternary Ice Age' to Praeger, "the discoverer of the climatic optimum." At the age of twenty-one, he analysed a section taken from Belfast docks and showed that there must have been a climatic period warmer than that of the present.[1] From this discovery came the concept of the sub-Boreal period and the way was opened for fruitful researches on postglacial climates. And paleobotanists in Ireland are still working on the country's peatbogs in association with Danish colleagues. Of the many honours he received he would not wish one to speak, but he appreciated the compliment

[1] R. Ll. Praeger, "On the estuarine clays at the new Alexandra Dock, Belfast," *Proc. Belfast Nat. Field Club* (a), II, Appendix, p. 29.

of a Vice-Presidency of both the Botany and Geography sections at the Belfast meeting of the British Association in 1952.

He wrote avidly: his books of essays and reminiscences gave pleasure to thousands, and his 'The way that I went' published in 1937 to commemorate his seventieth birthday, is an attractive mixture of geography, natural history and personal reminiscence. It was as a field scientist that Praeger excelled: his 'Botanist in Ireland,' 1934 (unhappily out of print) gathered together the researches of more than forty years. A man of powerful physique, he knew the country from end to end because he had walked it with his charming wife and others: from choice he never owned a motor car. If he suspected that a rare plant was to be found across a lake, he swam to it, carrying his clothes in a patent rubber bag he had invented for the purpose. As his investigations led to the conclusion that research on Ireland was only just beginning, so he encouraged every possible enterprise. He worked sedulously to foster the scientific work of the Royal Irish Academy, the Royal Dublin Society, the Dublin Naturalists' Field Club and many more organizations. Before the 1914–1918 war, he was in close touch with W. B. Wright the glaciologist and Grenville Cole the geologist who pleaded so constantly—but unsuccessfully—for the cause of geography in Ireland.

In 1934, Praeger and a group of friends founded the Geographical Society of Ireland: at that time, great tact was needed to draw into the membership those who wished everything to be conducted in Irish as well as those of an opposite view. Wisely, the Irish-less Praeger compromised and Irish-speaking meetings were held as well as those in English: in time, the society conducted all its affairs in English. Every move to encourage field research in geography had Praeger's warm support: he rejoiced in the existence of "Irish Geography" and of the Society's fieldweeks. With his devoted wife, he attended every meeting and sat in the front row. As time went on, he became increasingly deaf and whispered "Can't hear" in fruity tones to the embarrassment of speakers, who found that the difficulty was not to make themselves audible to those at the back of the hall but to the loved old gentleman in the front row. Almost to the end his days were planned: he wrote from 8–1, lunched, went in the afternoon to the cinema, and in the evening generally to a meeting. He spent his retirement thus happily employed, and lived in a tiny flat near the centre of Dublin so that he could enjoy the life of the city he knew so well. In 1952 Mrs. Praeger died: they had no children and it was clear that he would soon follow the lady who is described in 'The way that I went' as "the dear companion of many wanderings."

T. W. F.

CORRESPONDENCE

DEFINITION OF HISTORICAL GEOGRAPHY

O. H. K. Spate criticizes J. N. L. Baker's chapter on "The Seventeenth Century" in 'An Historical Geography of England before 1800' because it does not seriously mention the Civil War and fails to discuss the geography of allegiance in that conflict (*Geogr. J.* 118, 420). He gives it as an example of "economic history plus maps . . . overlooking political sequences and distributions," thereby implying that he would prefer to see political history plus maps. In fact, Dr. Spate is complaining that Mr. Baker has not included "the

influences of geographical factors upon historical events"; but this version of historical geography is explicitly rejected by the editor of the work to which Mr. Baker's chapter was a contribution, in favour of "the reconstruction of past geographies" ('An historical geography of England before 1800,' Preface by H. C. Darby, p. vii).

It is unfortunate that Dr. Spate, in his unwillingness to conform to the generally agreed definition of historical geography, should single out another geographer for attack on no better grounds than that he has written within his terms of reference.

W. H. PARKER

Hamilton, Ontario,

27 *April* 1953

AN EXPEDITION TO NORWAY

PROFESSOR KRISTIAN GLEDITSCH, M.B.E.

The *Geographical Journal* March 1953 contains on page 117–8 a report from an expedition to Lyngen in North Norway. The author is perfectly right in saying that this area had formerly "only . . . been roughly mapped." The maps were made in very great haste nearly ninety years ago. It is easy to see the errors to-day.

Later however the author makes the following statement: "Norwegian Government Surveyors are working on an amended survey of Lyngen, but the new maps examined suggest that no detailed survey of the interior mountains and glaciers is being made, the coastal and easily accessible areas alone receiving attention."

I am not sure what exactly is meant by the expression "an amended survey." No attempt is made to amend the old maps. The survey work which is now rapidly progressing in this district is a completely new mapping made by aerial photogrammetry *based on modern triangulation* (which is not the case of the plane-table maps and sketches of the expedition). I am very surprised to learn that the author has examined the new maps. So far none of them have been published. When they are, in a few years from now, I am certain that the author will admit his mistake in stating that "no detailed survey of the interior mountains and glaciers is being made."

It is rather a pity that the strenuous efforts of this expedition have been almost wholly wasted. The "new discoveries" are all on our air photos and will in due course appear on the official maps. I think it would be an advantage to all parties concerned if expeditions planning surveys in civilized countries would beforehand get in touch with the responsible mapping agency of the country.

KRISTIAN GLEDITSCH

Oslo, May 1953.

Director of the Geographical Survey of Norway
President of the Norwegian Geographical Society.

MEETINGS: SESSION 1952–53

Meeting of 20 April 1953. The President in the Chair

Elections to Fellowship: Mrs. Selina I. Adewusi; Adebiyi O. Adeyi, M.A.; Gilbert Davis; Mrs. H. M. D. Futo; John Maitland Hunt; Christopher W. Kaye; John Liddington; Eric J. Morgan; Nevil Shute Norway; Commander Maurice C. Pascoe, R.N. (retd.); Colonel Richard Proud, I.A. (retd.); Rev. Clifford Reeves; Miss Catherine M. Roberts; Arthur H. Thrower; Percy Whitford; Professor Muhammad Yunus, M.A., PH.D.

Paper: Amazon Adventure. By Sebastian Snow

Meeting of 4 May 1953. Professor A. A. Miller in the Chair

Paper: Appalachian Relief. By Professor P. de Béthune

Meeting of 11 May 1953. The President in the Chair

Elections to Fellowship: Norman S. Atherden; Miss Annis M. Heawood; John Barrie Horwell; Edward A. Hutchinson; John James Lawrie, B.SC.; Paul Maasland, M.L.; Dr. Horace Manley; Mrs. Robert Needham; John Odgers, B.SC.; Flight-Lieutenant P. Hayter-Preston, R.A.F.; Lieutenant Nigel Rogers, R.N.V.(S.)R.; Ross O. S. Salmon; Flight-Lieutenant G. L. Verran; William Carr Watson; Fakhar B. Zar, B.SC., M.A.

Transferred from Associate Membership: Henry H. Cook; H. C. Prince

Paper: The East Anglian floods. By Professor J. A. Steers

Meeting of 18 May 1953. Mr. Leonard Brooks in the Chair

Film: Stanlow story. A sound film

Meeting of 1 June 1953. The President in the Chair

Paper: Recent economic trends in Arizona. By W. G. V. Balchin and Norman Pye

Meeting of 8 June 1953. The President in the Chair

Elections to Fellowship: Richard T. Arnold; Miss Beverley Gay Atkinson; Colin A. Baker; Ian Wright Bell; Colonel Eugene St. John Birnie; Alfred P. S. Clark; Captain M. H. Clarke; Theodore S. Clerk; Maurice E. Constable; Stephen Thomas Crump; Robert George Dovers; Albert S. Eastwood, B.A.; Dr. Charles R. Eberhardt; Clyde R. Farquhar; Flight-Lieutenant Albert E. C. Gleadle, R.A.F.; Russell William Gray; Arthur Stanley Helm, M.A.; George Henderson; Kenneth Herbert; Herbert C. Barbour-Hill; J. Hodgekins, B.A.; John Hunter, B.A.; Kewal K. Jalota; A. Rahim Khan, M.A.; William Layton, B.SC.; John James Mackay; Norman P. K. McLeod; James Ivor Marsh; Rev. Russell James Mills; Miss Cecilia Monaghan; Alexander Rankin Muir; Brian F. Nicholson; Thomas Henry Nottingham; Miss Yolande Oakley; Miss Dorothy Richardson; Commander John Roberts, R.N.; Hurrydhaw B. Singh, B.A.; D. M. Stanton; John H. L. Turner; John T. K. Vellu

Elections to Associate Membership: Miss Norma Agnes Devine; Miss Shelagh Marion Giles; Miss Mary E. Heighes; Arthur A. Spencer; John Francis Day

Paper: Two principalities in Central Asia. By Ian Stephens

The following to Fellowship and Associate Membership of the Society on 20 July 1953

Elections to Fellowship: Rev. Stanley Best, B.A.; Daniel Carpenter; R. McKenzie Clough; Robert Wooster Cowen, B.SC.; Robert J. Daugherty;

Miss Frances M. Delany; J. A. V. Downend; Harold P. M. Dumbrill, B.A.; Reginald C. F. Dunkin; Wilfred Ellis, B.SC.; Miss Kathleen Ethinaj; David H. S. Evans; Arthur Michael Ferrier; Lieut.-Colonel Herbert E. Fooks, O.B.E.; Thomas Fothergill, B.SC.; Mrs. Sibyl M. Fyson; Anthony W. D. Gatrell; Godfrey R. Gould, B.SC.; John Charles Grover, B.ENG.; O. Hinchliffe, B.A.; Donald A. Holm; Maxwell W. Hopkins; Kenneth H. Huggins; R. Vyvyan Johns; Thomas Fillans Kennedy, M.A.; The Countess of Kintore; Robert Arthur Kitson; John B. Knighton; Charles J. McCaffray; Robert D. MacDougall; Miss Nancy Gray McKenna, B.SC.; Leslie Albert Matten; Dr. Ronald Miller; Captain F. R. G. Milton, M.C.; A. L. Morrison, B.SC.; Terris Moore; Homer C. Mueller; Rev. J. Palmer Muntz, D.D., LL.D., Litt.D.; N. Sankaran Nayar, B.A.; Paul H. Northcott, B.A.; Miss Edith Peters, B.A.; William M. Pybus; Cyril Edward Reynolds; George Edward Roffey; Mrs. Margaret E. E. Rutherford; Alan Wood-Saunderson; Rev. R. J. G. Simpson; Edward J. G. Smith; Michael Floyd Steeler; Ian Melville Stephens, C.I.E., M.A.; Dr. Norman Taylor; Joseph Tragen; Rev. Dwight Wadsworth, M.A., PH.D.; Oliver Samuel Walkey; Gerald W. Seth-Ward; Lieut.-Colonel G. E. Wheeler, C.I.E., C.B.E.; George M. Wilson; Miss Sylvia M. Wood; R. D. Yabsley, B.A.; Rev. John Henry Woodward

Elections to Associate Membership: Edward Barry Gent; Michael Bruce Graham; Roderick Galbraith Jones; Miss Anna Sykes

ANNUAL GENERAL MEETING, 22 June 1953. THE PRESIDENT, Mr. J. M. WORDIE, in the Chair

The HON. SECRETARY, Mr. Leonard Brooks, read the Minutes of the Annual General Meeting held on 23 June 1952, which were confirmed and signed by the President.

The PRESIDENT: We now come to the presentation of the Medals and Awards. This year, the *Founder's Medal*, with the approval of Her Majesty the Queen, has been awarded to Mr. P. D. Baird, Director in Montreal of the Arctic Institute of North America, for his explorations in the Canadian Arctic. Mr. Baird's Arctic work dates from the end of his Cambridge course in 1934, when he was one of my companions on a summer expedition to North West Greenland and Baffin Island. Two years later he returned to the Arctic and spent the winter on Southampton Island with a party led by Mr. T. H. Manning. He was back again in 1938, this time with one companion, Mr. Reynold Bray, at Igloolik at Fury and Hecla Strait. Mr. Bray lost his life and after reporting this at Repulse Bay Mr. Baird returned to Igloolik and spent the spring and summer of 1939 on Bylot Island. On the outbreak of war he joined the Canadian Forces, and six years later, as Lieutenant-Colonel Baird, he was in command of the field work of operation "Musk-ox," when a team of weasels reached Victoria Island. This expedition called for outstanding qualities of leadership and planning, and was an enterprise which contributed not only to military but also to scientific knowledge of Arctic Canada.

Since the war Mr. Baird has been actively engaged in Canadian Arctic affairs, and in 1950 organized and led a large scientific expedition to the Barnes Icecap on Baffin Island, which he himself had been the first to sight at a distance in 1934. This coming summer he will lead an equally important expedition to a smaller icecap on the Penny Highland several hundred miles to the south.

Mr. Baird cannot on that account be with us this afternoon. In inviting His Excellency the High Commissioner for Canada, Mr. Norman Robertson, to accept this Medal on Mr. Baird's behalf, I am sure you will also wish me to

ask His Excellency to forward to Mr. Baird the best wishes of the Society for the successful outcome of his second expedition.

The HIGH COMMISSIONER FOR CANADA (Mr. Norman Robertson): Mr. President, it is a great privilege for me to represent Mr. Baird this afternoon and to accept the Founder's Medal on his behalf. This recognition by the Royal Geographical Society, with which he has been associated in his work these many years past, will mean a great deal to Mr. Baird and his colleagues in the field of Arctic exploration in Canada. Mr. Baird's work there is being carried forward with great help from this country of yours, from Switzerland and also from the United States of America. Through the Arctic Institute of North America it involves the work of many Canadians also.

You have had the pleasure of hearing the progress report on the expedition, referred to by Mr. Wordie, to Baffin Island in 1950. Mr. Baird is already in the Far North and I wish now on his behalf to thank the Royal Geographical Society and assure you that this honour will be greatly appreciated in Canada.

The PRESIDENT: The *Patron's Medal* has been awarded to Count Eigil Knuth, leader of the Danish Expedition to Peary Land in 1948–50. Count Knuth is known to many as an artist and sculptor, but still more to our Fellows as a distinguished explorer and authority on Eskimo history and archaeology.

The expedition to Peary Land marked an entirely new phase in exploration technique in Greenland. For the first time the main base in Peary Land was established by flying boats from a rear base at Young Sound at a distance of some 500 miles. Till then Peary Land had only been very briefly visited by sledge parties in the spring when the ground was entirely snow-covered. The setting up of a base hut at Peary Land enabled exploration to be carried out during three successive summer seasons when not only was the ground snow-free but also, contrary to anticipation, the temperature did not fall below freezing point during these months. The main finding of the expedition was the discovery of the living conditions of former Eskimo inhabitants in the most northerly region in the world.

Like Mr. Baird, Count Knuth also is again working in the field, in Greenland, but it is a pleasure to know that an old and close friend of the Society, His Excellency the Danish Ambassador, Count Reventlow, is here this afternoon to receive the Medal on Count Knuth's behalf.

H.E. THE DANISH AMBASSADOR (Count Reventlow): Mr. President, I am very grateful to you for the kind words you have spoken about my countryman and for your generous appreciation of the work he has been able to do. I am most happy to be present on this occasion to accept this Medal on his behalf. I know that he is very appreciative of this signal honour.

Although Count Knuth would very much have liked to be here himself, he has a good reason for not being present: his long journey has not yet ended. He will have been away altogether six years, part of the time on the Ice Cap somewhere near Peary Land. Count Knuth has an affection for Britain and he is grateful for the inspiration he has received from the Royal Geographical Society, with its splendid traditions in exploration all over the world; also he has great regard for the pioneer work you have done in Greenland.

The conquest of Mount Everest is in all our minds at the moment. All the people in Denmark have followed with the greatest interest the efforts of the British team and are happy to know that the British have reached the summit of the highest mountain in the world.

Thank you, once more, for the award to my countryman, Count Knuth, through whom you have also honoured my fellow-countrymen.

The PRESIDENT: The *Founder's Medal* and the *Patron's Medal* are Royal

Medals and these awards have been approved by Her Majesty the Queen. In addition we have the Society's own Gold Medal, the *Victoria Medal*, which is this year awarded to Sir John Myres, Emeritus Professor of Ancient History in the University of Oxford. It is awarded for his contributions to the geography as well as the history of Greek and Mediterranean lands, and also for his services in the development of geography in education.

Sir John Myres, who was born in 1869, is unable at his advanced age to undertake the journey from Oxford to London. The Medal this afternoon will be received by his son, Mr. J. N. L. Myres, Bodley's Librarian at Oxford. Sir John Myres' distinguished career as an historian and classical scholar is well known and his two recent books of collected essays and on Herodotus link him very closely with our Society; many of the essays were first published in the *Geographical Journal*. His work has shown how important to the historian is a knowledge and understanding of the geographical environment. Samuel Purchas has said "History without that so much neglected study of geography is sick of a half dead palsy." I need hardly say how admirably Sir John Myres has striven throughout his long and vigorous life to satisfy Purchas's idea of a satisfactory historian.

Mr. J. N. L. MYRES: Mr. President, I stand before you this afternoon *in loco parentis*. My father has written a message to you which he has asked me to read on his behalf as he was unable to come here. His message is as follows:

It is a great honour, Mr. President, and a very special pleasure to receive at your hands this Victoria Medal, which brings with it so many memories of the distinguished geographers who have received it in past years.

To me it is a peculiar satisfaction to be cited for work in the two aspects of Geography which have always most keenly interested me, the ancient geography of Greece and Greek lands, and the establishment of Geography as a leading subject in national education, to which this Society has contributed so keenly and generously. It is the duty and privilege of members of a Society such as ours, to hand on their own contributions to those who come after; and I gratefully acknowledge the generous help and wise counsel that I have always received from such men as Scott Keltie and Mill in the Society here, and from Mackinder and Herbertson at Oxford. It has always been my endeavour to be worthy of such encouragement, and to pass on to the younger geographers, and especially to the travellers in Greece, and to teachers, the same services to learning. In this endeavour, Mr. President, I render through you to the Society my gratitude for this distinguished Award, and my sincere good wishes for the Society in its great work.

The PRESIDENT: The *Murchison Grant* goes to Mr. G. B. Stigant of the Hydrographic Department of the Admiralty for his long labours there, and especially for his studies of the Japanese coasts. The Society has always been closely linked with the Hydrographic Department and it gives us much pleasure to make this award to a distinguished member of the staff.

Mr. G. B. STIGANT: On this notable occasion I could wish for the gift of eloquence because I feel that the high honour you have done me in awarding me the Murchison Grant is conferred also upon my fellow cartographic workers everywhere, and will be taken by them as an encouragement in their work. I thank you, Mr. President, for your kind references to my work relating to the Cartography of the Japanese region. You referred to the close relationship which has existed between the Society since its earliest days and the Hydrographic Office. In several ways it is true also that both bodies have been closely concerned with the mapping authorities in Japan and with the progress of surveying there. The Society's interest is apparent from the mention in the

President's address in 1870 of the work of H.M.S. *Sylvia* which actively cooperated with the Japanese in their first hydrographic survey in 1869. Earlier in 1861 H.M.S. *Actaeon* under Commander Ward had carried several Japanese officials during her surveying duties and had received from them the gift of a very valuable map of Japan now in the Maritime Museum, Greenwich, based apparently on the work of the early Japanese Surveyor Inō Chūkei. Another link existed in the person of Henry Sharbau, an old servant of both the Hydrographic Office and of the Society. Born at Lubeck in 1822 he came to work here as a young man and was employed on hydrographic surveys in 1858 and 1864. In 1874 he obtained an appointment under the Japanese Government, and some time after his return to this country he was appointed draughtsman to the Royal Geographical Society. It is difficult to get exact details of his work in Japan but it is at least partly due to him that Japanese charts and maps are so readily intelligible to us—more intelligible, I dare say, than any others using non-Roman writing.

The PRESIDENT: The *Back Grant* has been awarded to Mr. G. de Q. Robin, originally at Melbourne University and more recently at the Physics Department of the University of Birmingham. His first Antarctic experience was in 1947 when he was the leader of the Falkland Islands Dependencies Survey party located in the South Orkneys. I was for a short time with Mr. Robin when he was setting up his winter station, and I can therefore speak at first hand of his qualities. He was an obvious choice to be the leading British scientist on the Norwegian-British-Swedish Antarctic Expedition to Queen Maud Land in 1949–52—an expedition where the British section was jointly sponsored by this Society and the Scott Polar Research Institute at Cambridge. Mr. Robin was responsible for one of the most notable results of that expedition, when a journey of nearly four hundred miles with weasels and sledges was made inland from the ice shelf to the plateau, and when as many as eighty soundings were taken of the depth of the ice along the route. Mr. Robin also is abroad, and the Back Grant will be received on his behalf by Dr. Fuchs, Principal Scientific Officer of the Falkland Islands Dependencies Survey.

Dr. V. E. FUCHS: Mr. President, When Mr. Robin asked me to accept this award on his behalf he asked me to emphasize his debt to all those people, both in this country and in Scandinavia, who in fact organized the international expedition. After all, the opportunity afforded to people working in the field was due to organization in the various countries concerned. Mr. Robin also wants particularly to thank all those members of the winter party who assisted him in the preparation and, indeed, with the work going on down there for which he is receiving the award. That work was, as you may know, carried out by means of weasles, tracked vehicles, and could not have been done without them because of the loads which had to be carried. It is of interest that in 1911 Scott used tractors in the Antarctic to draw his loads on his long journey. In those days the engines were far from reliable and they packed up very quickly, but Scott had great faith in their future and said they would prove of great advantage in Polar exploration in after years. Here we have an example in Mr. Robin's work of the use of tracked vehicles travelling far distances with heavy loads. That was what Scott foresaw, and that has now come to pass. The vehicles were used for the first time by the expedition in the Antarctic. In the north they have been used for some time under similar conditions.

Finally, the geophysical aspect of Mr. Robin's work has been particularly mentioned, and he wished me to point out that it was the team that carried out that work. The team associated with him were Mr. Peter Melleby of Norway,

and Mr. Charles Swithinbank of this country. Mr. Robin wished me to bring their names before you when I accepted this grant on his behalf.

The PRESIDENT: The *Cuthbert Peek Grant* goes this year to Duncan Carse, who is no doubt well known to you in other spheres than the purely geographical. Mr. Carse is the organizer and leader of the South Georgia Survey which worked there in 1951–52 and which it is hoped will complete its geographical and geological programme in the Antarctic season of 1953–54. Mr. Carse has been supported and encouraged throughout by His Excellency Sir Miles Clifford, Governor of the Falkland Islands. His findings on the first visit have already shown the inadequacy of the South Georgia coastline as previously known, and when the results are fully worked up after the second visit there will be an entirely new map and a new coastline of the Dependency. The Cuthbert Peek Grant is intended for those who are about to carry out field work, and Mr. Carse admirably fulfils the Founder's wishes. In presenting the award I should like to convey to him our hope for continued success on the island of his choice.

Mr. DUNCAN CARSE: Mr. President, I have always looked upon Polar exploration rather as a vocation, as something which one cannot help oneself doing, a job which is all one requires or asks for. I thank you, sir, and the members of the Council of the Society for so honouring the work done by a very small and somewhat short expedition. I regard the award as an encouragement not only to myself but to my former fellow-explorers to go back and have another go. And that we shall do.

The PRESIDENT: Finally, Mr. B. H. Farmer receives the *Gill Memorial* for his studies in land use in Ceylon. Mr. Farmer's interests in Ceylon were first aroused when he was stationed there for a short time during the war. His land-use studies were carried out about a year ago during a six months' visit, and from an economic point of view have been warmly welcomed by the Ceylon Government and recognized as of very great importance. Mr. Farmer is a Fellow of St. John's College, Cambridge, and holds a University lectureship. He is also actively interested in the teaching of geography in schools; and has recently been concerned with the inclusion of field studies in the geographical syllabus of the Cambridge Local Examination Syndicate. The award is made primarily for his work in Ceylon, but your Council were also impressed by the important advance which he has helped to achieve in the teaching of geography in British schools.

Mr. B. H. FARMER: Mr. President, I am indeed most grateful to the Council for this honour, but I am conscious as I stand here that the work which your Council has been so kind as to recognize owes a great deal to a variety of individuals and organizations. For example, to my University and College for giving me leave of absence; to the Royal Institute of International Affairs, to the Leverhulme Trustees and to the Society for financial help; and to a whole host of people in Ceylon itself who by their interest, encouragement and assistance made the work possible. Thank you very much indeed.

The PRESIDENT then delivered his Presidential Address which is printed on pp. 257-65.

Visitors having retired from the meeting,

The PRESIDENT appointed General Sir Charles Bell and Mr. G. Sanderson to act as scrutineers of the ballot for the Council and Officers for the ensuing year.

The PRESIDENT: While the ballot is in progress, Fellows may like to comment on the Annual Report.

The Hon. Secretary, Mr. Leonard Brooks, having explained the main features

of the financial statement, said: As to the present year, I have been asked several times what has been the effect of raising the subscriptions. We cannot tell at present. The number of Fellows who have sent in their resignations is small, but there are one or two factors which make it impossible until the end of this financial year to say exactly what the position is likely to be. We introduced covenanting at a Special General Meeting and that should give us this year about an extra £1000 income. There is a great need to increase the income of the Society and hence for more Fellows to covenant. The Council is very anxious to increase the services rendered to Fellows but this cannot be done unless the income is increased. I cannot see much opportunity for decreasing expenditure.

Captain PERRY SHAW: I know it has been the custom of the Council to put the value of the investments at cost. Generally the Auditors have quoted at a much lower figure. What is the idea of that practice?

The HON SECRETARY: We do this on the advice of our auditors, but we also give the value as at the end of December. Most organizations give their assets at cost.

Mr. G. BYFIELD: I happen also to be a Fellow of the Royal Astronomical Society and they have found it a great advantage for Fellows to enter into a seven-year covenant. I would like to enter into a seven-year covenant for the subscription so that the Society can get the benefit of the income tax returned.

The HON. SECRETARY: Every Fellow has received a notice in regard to covenanting. You cannot now covenant for 1953 because you had to do so before the date on which your subscription was due. We hope by the end of this year to have more Fellows covenanting, but there are certain factors which lead us to think that we must not be too optimistic about that.

The PRESIDENT: Covenanting is a most complicated business; we have been discussing it for the last year or so, and I hope it has now been settled.

On the motion of Professor KENNETH MASON, seconded by LORD NATHAN, the Report was then adopted.

The scrutineers informed the President that the list of candidates proposed as Officers and Council for the ensuing year had been elected (see list, p. iv).

The PRESIDENT, having declared the Council and Officers, as proposed, duly elected, said: As there is no other business, ladies and gentlemen, that concludes the meeting and I thank you for your attendance.

THE ANNUAL DINNER

The Annual Dinner was held at the Hyde Park Hotel on Monday 22 June 1953.

Mr. J. M. Wordie (President of the Society) and Mrs. Wordie received the company which included, among the guests of the Society.

His Excellency Count Eduard Reventlow, the Danish Ambassador, Sir Edwin and Lady Herbert, the President of the Royal Academy and Lady Kelly, Lady Plender, General and Mrs. E. F. Norton, Mr. and Mrs. J. N. L. Myres, Mr. G. B. Stigant, Mr. and Mrs. B. H. Farmer, Mr. and Mrs. Duncan Carse, Mr. Francis Mathew, General and Mrs. Bruce, Colonel H. W. Tobin, Colonel D. G. Lowndes, Mr. and Mrs. Hugh Ruttledge, Mr. H. W. Tilman.

After the Loyal Toasts, Sir EDWIN HERBERT (Chairman, Joint Himalayan Committee of the R.G.S. and the Alpine Club) said: To me has been allotted the task of proposing the toast of "The Royal Geographical Society." My pleasure in so doing is increased because I represent the Alpine Club which has

been your partner in a glorious adventure, recently brought to a triumphal end. A father aged 123 and a mother aged 97, or it may be a father aged 97 and a mother aged 123, after thirty-three years of married life have produced a family. Fed, clothed, provided with pocket-money, and even with means of breathing, by their proud parents, they have reached what we believe to be the highest point on the surface of the Earth. It is a glorious adventure, both in exploration and in mountaineering, and it is interesting to see how those two related characteristics have gone hand-in-hand all the way through. From 1922 it was all a matter of exploration until that détour through Tibet was discovered and the way to the mountain actually overcome. When Tibet became closed and Nepal open, it was once more a matter of exploration, and a way was found through the tangle of ridges and valleys of Nepal to the south side of Everest.

I would not like to-night to try to recall all the great mountaineering feats that have been achieved. Each time anybody has been to that mountain he has done something more than was done by his predecessors, and always something more than the scientists and the physiologists have believed to be possible for the human frame to undertake. There are two outstanding feats which I recall. One was that frightful climb of Norton, Mallory and Somervell to the North Col to rescue four porters marooned there, which very nearly wrecked the chances of their expedition, something which was in the finest possible tradition of exploration and of mountaineering. The second great feat is that of the solitary Odell in search of Mallory and Irvine, going up as though the mountain were his own private property to 27,000 feet, carrying oxygen apparatus which he did not need to use himself. We remember the names in turn: Norton and Somervell, Mallory and Irvine, Finch and Bruce, Wyn Harris and Wager, Shipton and Smythe—and others, each pair carrying on to a stage further than the previous pair. It is always the story of pairs. And who minds—who could mind?—whether we name one of those pairs before the other? Then we come to the south side of the mountain and we find pairs once more: Tilman and Shipton, Bourdillon and Evans, and the last pair Hillary and Tensing. Does any of you care, or ought any of us to care, what the nationality of one or other of the members of those pairs may be? And does it in the least matter in which order we name them? Hillary and Tensing or Tensing and Hillary? I am very glad indeed that the Swiss had a go on the south side of Everest and nearly got up to the summit. I am glad to think that there is one point on the Lhotse wall which bears a Swiss name, Éperon des Genèvois, and I hope that for all time that point will continue to bear that Swiss name.

I suppose there are few who have made more in the way of contribution to this joyous adventure than our friend Eric Shipton. I am inclined to think that if we could ask Everest who the mountain thought was its most persistent opponent the mountain might be disposed to say Shipton; and Shipton seems to me to be the embodiment of the spirit which has made the climb possible. I have in my hand a very recent letter from him, and this is what he says: "It was wonderful news about Everest and I was delighted that it was Edmund Hillary who succeeded in reaching the top. He is a splendid mountaineer and a delightful person. I am very glad, too, that Tensing was there to represent the Sherpas. There is no doubt about it that John Hunt has done a great job of work and the Committee were amply justified in selecting him." That is the spirit in which Everest was climbed.

As to Colonel Hunt's achievement I am going to say very little; his plan was so good and so perfectly executed that he has made it look easy, almost inevitable. Let us remember that nobody in that party is ever going to say anything to remove that impression. Therefore I am going to do it now!

That face that has been climbed was first seen by Mallory on the 1922 reconnaissance when he looked down into the West Cwm from a point on the left flank of the main Rongbuk glacier. He rejected the icefall and the Lhotse face, and never gave another thought to climbing the mountain by that route. When the Swiss went there they proved that it was possible to get through the icefall. They did not believe more than one or two parties could get up the Lhotse wall to the South Col. Hunt has been with 30 people, to the South Col—11 members of the expedition and 19 Sherpas. And they carried up to that South Col, which the Swiss thought impossible as recently as last year, enough equipment to launch a successful assault party.

However, I am not really on my feet to talk about Everest, although I could not quite avoid it. I came to propose the toast of "The Royal Geographical Society," but if you want remarks of unqualified admiration or adoration I am afraid you have come to the wrong person. There have at times been differences of method and outlook and emphasis between the Alpine Club and the Society that have caused a certain amount of irritation. When I was the Hon. Secretary of this Joint Committee Arthur Hinks used sometimes to drive me mad with his talk about plane-tables and phototheodolites when I was worrying my head off as to how to find the money to find the boots, ice axes, crampons, ropes and the other necessary means to get up the mountain. However, soon all was well again; everything is bound to be well between the explorer and the mountaineer because we have a common ancestor. That common ancestor is a bear, that immortal bear in the nursery rhyme, that went over the mountains to see what he could see. Why? To earn dollars? To help the balance of payments? To get fame? To get money to do the things which make any activity respectable today? Not a bit of it. He went because he liked it. He went over the mountains for the sake of going over the mountains and to see what he could see on the other side. And when he got to the other side of the mountain what did he do? Make a map? Perish the thought. He went over mountains again to see what he could see.

When we are all together and talking as friends do we not admit that the real reason why we climb mountains and the real reason why we explore unknown places is to see what we can see? We go because of adventure for its own sake without any ulterior object or motive. I am certain that is what makes the 123-year-old Royal Geographical Society such a young, active and virile institution still, and it is a quality which in my humble belief is very much needed in these serious days when one always has to find some reason or other, a respectable reason, for doing what one just wants to do for fun!

What about the future? I beg you geographers not to find that Everest is not the highest mountain! Every kind of enterprise is open to you, but not that. You have got now as far as you can to the North and as far as you can to the South, and as far as you can get upwards. What next? Are you going downwards? Personally, I believe there is ample room for above-ground exploration in the mountain ranges of the world to keep us together in happy cooperation and busy for many years to come. There are mountains to be climbed. There are rocks to be analysed. There are plants to be collected. There are a few animals to be seen including, I hope, my immortal bear whose footsteps are to be found, as we all know, all over the Himalaya; and in that pursuit of mountain exploration I hope we shall stay together with the same happy, warm, united cooperation as we have enjoyed for the past thirty-three years, and which has been rewarded by this very happy result in this wonderful year 1953.

I give you the toast of "The Royal Geographical Society," coupled with the name of your President.

The PRESIDENT (Mr. J. M. WORDIE): I much appreciate the very kind way in which Sir Edwin Herbert has proposed the health of our Society. We have been partners for many years. In the early days we were known as the Mount Everest Committee, but we felt a change of name was necessary, but that is not a sign of marital infidelity. There was a still earlier time when the two bodies, the Alpine Club and the Society, were very closely joined together; in the days of that formidable man, Douglas Freshfield. Freshfield's memory is beginning to fade, but he was one of the outstanding climbers at the end of the nineteenth century. He was President of the Alpine Club in 1893 and he was President of the Royal Geographical Society in 1914. You may wonder why there was an interval as long as twenty years. It can be easily explained. It was a case of Greek meeting Greek. Douglas Freshfield found himself in contest with Mr. G. N. Curzon, as he then was. Countess Ravensdale, Lord Curzon's daughter, is with us to-night, and I must be careful what I say. The trouble which arose so far as Freshfield and the Royal Geographical Society were concerned was that Freshfield wanted to admit women as Fellows of the Society. Curzon took a strong part in the Council against the admission of women, and he carried the day. Lord Curzon in due course became President of the Society in 1911, and almost the first thing he did was to admit women as Fellows! That seems to have healed the breach. Freshfield had resigned his secretaryship in 1893, but now he was back in the fold and succeeded Lord Curzon as President in 1914. A great many things are attributed to him; he had a forthright manner; he liked his own way; he was a typical mountaineer and individualist. There are few now who remember Freshfield except those of his generation left among climbers. But I refreshed my memory by looking up one of Freshfield's papers which was entitled "Mountains and Mankind," an address he gave at Cambridge in 1904. I hope you will allow me to read one passage illustrating Freshfield's style, and with which he seeks to show how people have appreciated mountains at all times:

"The Vale of Tempe, the deep gap between Olympus and Ossa, beautiful in its great red cliffs, fountains, and spreading plane trees, was part of a Roman's classical tour. The superb buttresses in which Taygetus breaks down on the valley of the Eurotas were used by the Spartans for other purposes besides the disposal of criminals and weakly babies. The middle regions—the lawns above the Langada Pass, "virginibus bacchata Lacaenis Taygeta"—are frequented to this day as a summer resort by Spartan damsels. The very top, the great rock that from a height of 8000 feet looks down through its woods of oaks and Aleppo pines on the twin bays of the southern sea, is a place of immemorial pilgrimage."

It was a fortunate circumstance for our two bodies, the Alpine Club and the Royal Geographical Society, that at the time the Everest Committee was formed we had two Presidents in the Society, Sir Francis Younghusband and Lord Zetland, both of whom were experienced in Himalayan travel. To-night one cannot avoid speaking of Everest. We welcome here among our guests some of the grand climbers of the past and leaders of earlier parties, and I cannot resist the wish particularly to welcome General Norton here to-night. Sir Edwin Herbert has mentioned two of the high spots of climbing when Norton and Somervell and Mallory went up to the North Col at 27,000 feet. There is one other outstanding feat which Sir Edwin Herbert has not mentioned, and that is that when Norton and Somervell reached the height of 28,000 feet and so raised the greatest height reached by man by no less than 1000 feet; they conquered the fear of great altitudes.

I thank you, Sir Edwin, for the very kind way in which you have spoken of the Society. We get on very well together and I sometimes wonder whether I

shall side with the Alpine Club or with the Society should there be an occasion for difference of point of view. Up to now there has been no such occasion.

Marshal of the R.A.F. Sir JOHN SLESSOR: I am privileged this evening to propose the toast of "The Medalists and Guests." The Royal Medalists, Mr. P. D. Baird and Count Eigil Knuth are not here for the very best of reasons—they are now actively engaged in explorations in Arctic lands. The Victoria Medalist, Sir John Myres, is not here either, but he is, I believe, represented by his son whom we welcome very much. The winner of the Patron's Medal, Count Knuth, is represented by a very old friend of the Royal Geographical Society in the person of His Excellency the Danish Ambassador, Count Reventlow. There has been close and happy cooperation between Danish and British explorers. An example of which we know at the moment is the North Greenland Expedition which is largely due to the interest and cooperation of Count Reventlow, and we could not be more delighted to see him with us to-night.

Count Knuth has made a speciality of Greenland, in particular of Peary Land, where in 1948 he was the first man to establish a base by air in the inner territory which prior to that had only been visited periodically by chaps with sledges. Count Knuth is not only a Polar explorer but an archaeologist and he has studied in a changing Polar environment the history and culture of the Eskimo. Greenland is a particularly interesting and important land from the air point of view, as anybody can see who studies a map on any less misleading projection than that of Mercator. Mr. Baird, again, is unfortunately not with us, but it must, I think, be a very special satisfaction to our President to be able to drink the health of this year's winner of the Founder's Medal, because Baird's first expedition to Baffin Island in 1934 was led by Mr. Wordie. Baird, as you know, is Director of the Montreal Office of the Arctic Institute of North America and he has won the Founder's Medal for exploration in the Canadian North. Incidentally, it is the sixth medal that has been awarded by the R.G.S. for Canadian exploration and it is the fourth awarded since the war, which is rather a remarkable record. The Victoria Medalist, Sir John Myres, again is not here. We have in him a great exponent of the influence of environment on history. His field is one which many of us would prefer to the frozen North; it is the Mediterranean. Sir John wins his medal for contributions to the geographic history of the Greek lands and for his services to the development of geography in education.

We welcome all our guests and I have already mentioned one whom we specially delight to honour, His Excellency the Danish Ambassador. We have also with us the President of the Royal Academy, and here I must say it was a great blow to me when I saw the Toast List to find that Sir Gerald Kelly was not to be coupled with Count Reventlow in replying to this toast, because I am sure all will agree that Sir Gerald Kelly usually is great fun when he gets on his feet on this sort of occasion.

Finally, I am not going to say very much about Everest but as proposing the health of the guests I must say how suitable it is in this wonderful year that we should have amongst us some of our old Everest allies. Reference has already been made to General Norton who has gone higher than any other horse-gunner I know of and has the distinction of being himself as well known as a horseman as he is a mountaineer. We have with us my old friend Geoffrey Bruce who was also on the 1922 and the 1924 expeditions. Eric Shipton is not here, but I cannot resist saying what a splendid thing I think it is that he should have taken on the Mountain School of Outward Bound. Mr. Tilman is here; he is not of the 1922–24 vintage but jolly good vintage all the same; and that

applies also to Mr. Hugh Ruttledge. I give you the toast of "The Medallists and Guests," coupled with, alas, only one name, that of Count Reventlow.

H.E. THE DANISH AMBASSADOR: It is a great honour to have been asked to respond to the toast of "The Medalists and Guests," and I do so with great pleasure. I am most grateful to you, Sir John, for your generous appreciation of the work done by my countryman, Count Knuth. I would like to say how sorry Count Knuth is not to be able to be here to-night; how much he loves this country of yours; and how grateful he is to, and how much he admires the Royal Geographical Society which for more than a century has supported so many explorations and particularly also has helped Denmark in exploring Greenland. I know Count Knuth is also very proud as a Dane to have received this honour at the same time as so many eminent British explorers and scientists. I am convinced that the other medalists share my feeling of gratitude towards the Society; I fear, however, that my qualifications for acting as their spokesman are far from satisfactory. As a humble civil servant I have never taken part in any exploration whatsoever. By the way, I have always been impressed by and interested in the fact that British exploration finds its recruits in such widely different circles. In my opinion this is in itself admirable and characteristic of the sportsmanship and fine morale of the British nation. I note that one of your bishops is an explorer. Members of the Danish clergy are, I am afraid, far behind in that respect, but when I retire, as I shall soon do, I shall do my best to encourage them to show that they are just as adventurous and as tough as their British brethren.

But in one respect I am fully qualified to speak for the medalists and guests, and that is in regard to my respect for and deep appreciation of the inspiring work of the Royal Geographical Society. Perhaps I may add on my own account an expression of my gratitude for the efficient help the Society has given in furthering the happy cooperation between British and Danish explorers, to which Sir John Slessor also was kind enough to allude.

I have spent altogether twenty-one years in this country and what have I not learned during that long period? Much of my work has been to write notes about more or less theoretical and not always very interesting subjects and to deal with matters regarding butter, bacon and eggs. I do not wish to say anything derogatory as to those edible commodities, it would certainly not do. On the contrary, I wish our British friends to keep on liking our foodstuffs and also to pay handsome prices for them! Nevertheless, there are other ties that bind our two countries together, one of them being our common interest in Arctic exploration. You may perhaps say that in the very old days our exploratory excursions were at times of a somewhat bellicose nature, but I have a happy feeling that the British have nothing against being reminded of the marvellous deeds of the Vikings! One of the reasons is, of course, that you keep smiling and wondering at the absurdity of a small country like mine having succeeded in carrying through an operation of which Napoleon was not capable!

The other reason for this sympathetic attitude on your part is, I believe, that the British themselves to-day, as of old, love and understand the value of adventure. It is this spirit which has now, to the delight of all your friends, made it possible for you, after many heroic endeavours, to plant the Union Jack on the top of the world. I can assure you that not only Count Knuth but all my countrymen would wish me to congratulate you very deeply on this splendid victory and to say that we rejoice with you and admire the members of the British Everest team for their courage, their sportsmanship and their endurance.

At the President's request, General E. F. NORTON also responded: I have

the honour to represent the guests who were members of previous Mount Everest expeditions. I represent parties who went to Mount Everest over a considerable number of years. Although I know most of the members of preceding teams, we were not on the mountain together. There are, however, two sentiments which we all shared.

The first is acknowledgement of the very great moral help and support which this great Society was to us in those sometimes rather difficult times. I have preserved to this day some letters sent to me by a former President, Sir Francis Younghusband, and a former Secretary, Mr. Arthur Hinks. They reached me out in Tibet sometimes when things were somewhat difficult, and no words of mine can express the tremendous moral support which those letters were to me, and I know that such support is forthcoming always from this Society for expeditions to-day, and in the future.

The second point on which I am sure that I am in agreement with all other previous members of Mount Everest expeditions is in a wholehearted admiration of the achievement of the present expedition. I do not think that it is wise to go into any details in analysing that achievement until one knows the full story. At the same time, I am sure you will find that we of previous expeditions are all agreed that it is almost certain that the expedition of 1953 has provided a model of how a Mount Everest Expedition should be controlled and executed.

I am not going into any of the details as to what they have actually achieved. The point I wish to touch on is their good sportsmanship. We have had some generous appreciation sent to us by members of foreign Alpine Clubs and similar societies, and that which I think I value most of all comes from that wonderfully tough character, Mons. Raymond Lambert, who, as you know, achieved the world record height last year, along with Tensing, and in his generous appreciation of what this year's expedition has done he particularly mentioned the word "sportsmanship." I notice the same word was used by His Excellency the Danish Ambassador in his speech this evening. That we should continue these expeditions in a sportsmanlike way means more to me than success or anything else. I feel you will all agree that this expedition which has just taken place is an outstanding example of sportsmanship. The mere fact that no Englishman was comprised in the final party to go to the top is only a demonstration of that. The whole expedition was even more a matter of good team-work than the previous expeditions on the northern face because the great difficulties there were at the approaches to the mountain. And if the leader, Colonel Hunt, did not, as were told at one time he might do, lead the second party to reach the top, what a very much finer contribution he made and what a much finer example of sportsmanship that he should have exhausted himself—and here again I speak without accurate confirmation—by I believe carrying a 50-lb. load on his own back up to 27,350 feet to establish Camp VIII, that essential link in the chain of ultimate success. If I were in Colonel Hunt's position I should value that achievement very much higher than if I had led a party to the top.

On behalf of all the members of previous Mount Everest expeditions here present and on my own behalf, I want to thank you, Mr. President, for the compliment that you have paid us in asking us here and for the very charming evening's entertainment you have given us.

The PRESIDENT: Before we rise and chat together, I think I should tell you of a very handsome gift which has been made by Dr. Hamilton Rice to the Society this evening. A few of you may have seen the beautiful copy of the 'Mariner's Mirrour,' of 1588, the year of the Spanish Armada, the first great

book of charts published in England. Dr. Hamilton Rice was to have been here but he sent a telegram earlier in the day much regretting that he was unable to come over from Paris. He is a very old friend of the Society whom we should very much have liked to have seen with us this evening. By way of forfeit he telephoned to Francis Edwards, and has presented the Society with what is one of the most beautiful volumes that we shall ever see in our collection. It is now in the safe hands of Mr. Crone, our Librarian, and you will have an opportunity of looking at the beautiful charts.

THE ROYAL GEOGRAPHICAL SOCIETY

KENSINGTON GORE, LONDON, S.W.7

FELLOWSHIP AND ASSOCIATE MEMBERSHIP

The object of the Society being the Promotion and Diffusion of Geographical Knowledge, it has always welcomed to its Fellowship those anxious to further this object by their interest and support, as well as those able to take a more active part in the work of discovery and exploration.

FELLOWSHIP

The Bye-Laws provide that a candidate for admission to the Fellowship of the Society must be proposed by a Fellow personally known to him and seconded by another Fellow. Further, that a candidate is not eligible until he (or she) is twenty-one years old, unless he holds a Commission in Her Majesty's Forces or he (or she) is a matriculated student of a University of the United Kingdom or the Self-Governing British Dominions. Proposal forms can be obtained on application to the Director and Secretary.

Every Fellow shall be required to pay on election *either* £4 as Entrance Fee and £4 as Annual Subscription for the current year and thereafter an Annual Subscription of £4 due on 1st January in each year; *or* a single compounding fee of £60.

The Entrance Fee and first Annual Subscription may be paid in four quarterly instalments of £2 each; or the Entrance Fee and first two Annual Subscriptions may be paid in four half-yearly instalments of £3 each. Thereafter the Annual Subscription may continue to be paid in four quarterly instalments of £1 each or two half-yearly instalments of £2 each respectively. Entrance Fee and Annual Subscription may be paid by instalments only where payment is made by Banker's Order. Half-yearly instalments shall be due on the 1st January and the 1st July; quarterly instalments shall be due on the 1st January, 1st April, 1st July and 1st October.

For Fellows who are under the age of 25 years on election the Entrance Fee shall be reduced from £4 to £2. The Entrance Fee and first Annual Subscription may be paid in four quarterly instalments of £1 10*s*. 0*d*. each or the Entrance Fee and first two Annual Subscriptions may be paid in four half-yearly instalments of £2 10*s*. 0*d*. each: thereafter payment may be by instalments as above. Entrance Fee and Annual Subscription may be paid by instalments only where payment is made by Banker's Order.

Fellows may compound for their Annual Subscriptions at any subsequent time by a payment of £60 less £2 for each Annual Subscription paid in excess of five with a minimum of £20 after 25 payments.

No Fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrear.

ASSOCIATE MEMBERSHIP

The Bye-Laws covering the terms of Associate Membership provide that—

1. *A candidate must be not less than 17 and not more than 20 years of age. He (or she) must be recommended by a Fellow, University or School authority.*
2. *Subscription shall be £2 per annum without Entrance Fee.*
3. *On attaining the age of 21 Associate Members become eligible for Fellowship. The Entrance Fee of £2 shall be waived provided they have been Associate Members for 3 years. Otherwise Associate Membership shall cease at the age of 21.*

All subscriptions are payable in advance, on the 1st of January in each year.

PRIVILEGES OF FELLOWS AND ASSOCIATE MEMBERS

The privileges of a Fellow or Associate Member include admission (with one Friend) to all ordinary Meetings of the Society, and the use of the Society's House, Library and Map-room. Each Fellow is also entitled to receive a copy of *The Geographical Journal*. Associate Members have the choice of receiving either *The Geographical Journal* or *The Geographical Magazine*. Associate Members may not describe themselves as F.R.G.S. and have no vote at Annual or Special General Meetings.

A pamphlet giving details of the Society and a copy of the Charter and Bye-Laws will be sent on application to the Director and Secretary.

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